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A. A. Gray, General Manager. H. S. Tuthill, Business Manager.
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THE 100-WATT GAS-FILLED LAMP.

With very little blowing of trumpets the manufacturers have recently placed on the market a 100-watt gas-filled lamp which bids fair to impart a remarkable stimulus to certain classes of interior lighting. The lamp has been in service too short a time for the thorough establishment of life records under working conditions; but the indications are that the improved efficiency as compared with the ordinary tungsten lamp and the absence of frequent renewals will lead to great popularity.

The bulb size in the new lamp is near enough to that of the 80 and 100-watt tungsten lamps to enable its use in many fixtures already installed. The filament is concentrated into a pretty small space, and the intensity of the illumination is so high as to make screening imperative. This is not much of a disadvantage, however, for the whole tendency of the times is away from bare lamps in well designed installations, and the ability to utilize from 130 to 150 candlepower with an expenditure of only 100 watts as compared with the delivery of about 80 candlepower from the same input into a vacuum lamp means a great deal to the consumer.

Progressive central stations are taking advantage of the opening afforded by the new gas-filled lamp, and are sending out solicitors quick to see opportunities to install it in place of existing 80 and 100-watt units of the vacuum type. In fact, there are doubtless many locations where the use of 60-watt lamps in semi-indirect or diffusing fixtures can profitably be abandoned by the consumer in favor of the newer lamp. More experience is, of course, desirable as to the fields of application, the possibilities of heating, and the quality of illumination under different conditions, but in a broad way there is no question that the art has registered another big advance and the central-station industry is again in the enviable position of being able to offer its customers more light for the same money, just as it was a pioneer in the introduction of high-efficiency incandescent lamps about a decade ago, to the lasting benefit of the public.

In some localities there is a movement afoot to cut down the energy consumption of lighting installations of the commercial type for the purpose of saving on the monthly bills. This is often a proper engineering procedure, but the central-station salesman stands on firm ground when he encourages the use of more light for the same money rather than the same volume of light for less outlay. Wholly apart from the size of the monthly bill is the relation of lighting to business effi-

ciency, and it has been proved over and over again that a liberal use of light is not only one of the best means of advertising, but it has a direct bearing upon the quality and quantity of work accomplished by employees, no matter what the class of business served may be. Central stations which lose no time in offering their customers the benefits of such improvements are those most likely to retain their loads in their present or increased magnitude.

ELECTRIC-RANGE PROBLEMS.

Steadily the electric range wins its way into favor among discerning users of central-station service. Within the last two or three years the widespread adoption of a rate of three cents per kilowatt-hour or thereabouts for electric cooking has done much to encourage installations of this kind. This rate enables a properly handled range to compete with dollar gas, but too much emphasis cannot be laid upon the importance of learning how to avoid the extravagant use of electricity. Promptness in cutting off current as soon as a given task is performed, keeping the demand down to the requirements of moderate heating when such will serve, and the allowance of at least a month by the central station in which the new customer may get acquainted with the possibilities of his equipment are points worth bearing in mind.

It often happens that in the first month's service of an electric range a customer will not handle the equipment with anything like the efficiency attained a little later. In one extreme case, for example, the first month's bill for electric service was $21; but the central-station manager saw the bill before it was mailed, and did not send it, preferring to look into the use of the equipment and to assist the customer to reduce his costs, with the result that the energy consumption was cut down to a total of $9 per month and the customer entirely satisfied with his service. A compromise was made on the first month's bill which was fair to both parties. As stated at the recent New England Question Box convention, an average allowance of one kilowatt-hour per person per day is reasonably accurate for electric-range estimates.

The diversity-factor of the electric range is a subject that will bear investigation. The cost of taking on this class of business is small in proportion to the revenue, for the load does not as a rule come on the peak. The diversity-factor of a group of 13 ranges in a Worcester (Mass.) apartment house mentioned at the convention was 5; that is, the maximum demand was 13 kilowatts with a connected load of 65 kilowatts. In apartments, however, the working hours and habits of life of the residents are on the whole similar, and an equal number of ranges scattered through a city would probably show a diversity-factor of 6 or 7. In view of the fact that the peaks do not coincide with the central-station lighting maximum, it would probably be safe to figure a diversity-factor of 10 with a large number of ranges sprinkled all through a town, although this does not take into account the losses in distribution, which, of course, tend to increase the station capacity perhaps 15 per cent above that required to serve a given number of installations at the door.

When it is realized that the per-capita revenue of an electric range comes to about $10 per year, the desirability of encouraging this class of business by the installment method or otherwise needs little emphasis. The cleanliness and economy of food attained are of real value in relation to health and market bills, and the present should be an admirable time in which to push vigorous campaigns for the extension of this sort of equipment, which until very recently was looked upon generally as a luxury.

THE CENTRAL STATION AND THE ELECTRIC VEHICLE.

That the extension of use of the electric vehicle is very largely dependent upon the encouragement given to this activity by the central station is amply demonstrated by a comparison of cities where such encouragement has and has not been given. A typical example of central-station activity is afforded by Memphis, Tenn., a city of medium size. The Memphis Consolidated Gas & Electric Company established several years ago in that municipality an electric garage where electric vehicles could be assured of proper treatment and care. This was operated for some time at a loss, something that can hardly be expected from a private garage. The results, however, have well justified this procedure. The number of electric vehicles in Memphis is now in excess of 200, of which 27 are trucks, and the garage is operating upon a paying basis, as well as supplying a profitable load to the central station.

Compare this development with the situation in another southern city of more than double the population of Memphis, and certainly greatly exceeding it in the number of the white population considered alone. This city has not more than one-quarter the number of electric vehicles found in Memphis, yet there is nothing inherent in local conditions to indicate less suitability of the electric here than elsewhere. It is significant, however, that the central-station company in this city has taken no active steps to encourage the use of electrics, or to ensure that those coming into use shall receive such handling as to become striking advertisements for the advantages of electric propulsion.

A somewhat similar comparison, showing the relation of the electric's popularity to the facilities provided for its handling, is found in San Francisco and Oakland, Cal. Oakland has much less than half the population of San Francisco, yet it has three or four stations for electric cars to one in the larger city, and boasts a larger number of vehicles. The difference can not be attributed to topography, either, as most of the cars used in San Francisco are found in the hilly residence districts.

Truly this is a field in which those who sow do the reaping. Battery charging is a desirable load for the central station, and it can be had in ever increasing quantity by giving appropriate encouragement to the electric vehicle.

HINDRANCES TO ELECTRIC-VEHICLE DEVELOPMENT.

In addressing the New England convention reported in this issue, Mr. P. D. Wagoner made a striking point to the effect that the pessimist in the central station is one of the most serious factors in holding back electric-vehicle development from its normal growth. The influence of this individual has been underestimated. If he keeps his central station from buying electrics for its own work, he probably has sufficient influence to make the company take a negative or at least indifferent attitude toward the use of electric trucks and passenger cars by the merchants and manufacturers and well-to-do residents of the city. This means the retardation of electric-vehicle expansion in that center, and if the community is a pivotal town, that is, the county seat, so to speak, of a wealthy territory involving suburban and contributory towns, the responsibilities of the pessimist are far-reaching in their adverse effects.

No matter how sincere this individual may be in his belief that the electric is not serviceable; no matter if his deductions have been based upon the unsatisfactory performance of one or more vehicles which have come under his personal knowledge, he is not justified in taking this stand. It is unfair to the company, to the users of service on his own lines, and to the community at large. Very often a man is held back from purchasing because of the first cost and because the operating expense and fixed charges in central-station work tend to run higher than in mercantile and industrial deliveries. As for the first, something must be allowed for the advertising value of the most up-to-date form of transportation available on land; but more than this, first cost is after all a secondary matter if it can be shown in figures that more work can be done at a less expense per unit by purchasing an electric or a fleet of these equipments than by adhering to horse-drawn or gasoline traction methods. Naturally a buyer likes to get his equipment at the lowest expense possible, but if a given outlay in money can be shown to pay for itself and leave something over, too, is not the actual investment required a minor consideration?

In the past there has often been too little appreciation of what the electric will and will not do; machines have been sold with insufficient regard for engineering and commercial requirements; and the public has not realized how far manufacturers have gone toward putting a well standardized product on the market. From all sides the importance of using the electric commercial vehicle intensively is being emphasized. The researches of the Massachusetts Institute of Technology show this as one of the cardinal elements of success. Cut down the standing time to the irreducible minimum, should be the motto of the user. What standing time will do in raising the cost per mile is evidenced by records of electric cable-truck service, which run up to 60 cents, compared with 11 or 12 cents in many other classes of central-station service; and yet this does not mean that an electric cable truck does not fill the bill, considering its carrying capacity and availability as a power tool in a field where labor costs tend to run to excess.

Finally, there is the question of service loading. If the time ever comes when the user is willing to limit his loads to somewhere near the capacity of his truck, it will then be possible for the manufacturers to build lighter equipments for a given tonnage. It is true that some of the lowest cost figures which are being attained today in heavy trucking over relatively long distances in city and suburban delivery are due to the facility with which the transportation department crowds on the merchandise above the rating of the machine. In one notable case a 3.5-ton truck was loaded with no less than 9 tons of leather; the body went down upon the springs so far that the tires wore a rut in the underside, and the machine finally stalled. The purchaser called up the local electric-vehicle representative and threatened to get rid of the outfit; but a little prompt work in unloading the truck, combined with the presentation of a few official city-scale records at the owner's office won the day, and the owner, agreeing never to place over 6 or 7 tons (!) on the truck thereafter, became one of the best repeat-order customers of the manufacturer. The lesson is obvious, and in no other way can purchasers more quickly obtain weight reductions with consequent increased mileage than by adhering to the capacity of their equipment.

ENGINEERS FOR CITY MANAGERS.

The plan of administering municipal affairs through a permanent manager who is given entire charge of all branches of municipal government is being widely adopted. In a very few years the number of such municipalities has grown to nearly two dozen, so that it was possible for the managers to hold a convention during the past winter to consider their common problems. While a number of the cities and towns adopting this method have the commission form of government, this is not true of all, and there is no necessary connection between the two. Obviously, where an elective mayor receives a salary for doing this work, it is not feasible to engage a manager to carry out the same duties, but there are many towns and villages without a paid mayor who can appoint a permanent manager to great advantage.

A significant feature of the city manager idea is the fact that a majority of the managers who have been appointed are engineers. We have already called attention in these columns to the large number of engineering problems which confront a municipal executive, and the advantage of having men with engineering training and knowledge in charge of municipal affairs. The city-manager plan naturally applies to the work the most fit type of man available, and consequently in the long run engineers will be commonly chosen for this service. Of itself, this will contribute greatly to the success of the innovation and the spread of its adoption. Under this system we may hope to approach the efficiency in municipal administration enjoyed by German cities.

Electrical Exports for January.

The following data on the electrical exports of the United States for January are from the government report on the foreign commerce of that month issued by the Bureau of Foreign and Domestic Commerce.

The total value of electrical shipments in January was the highest since last May, but was nearly 10 per cent below the total of the corresponding month a year ago. In the four classes for which numbers of articles exported are given, there were shipped in January; electric fans, 1,278; arc lamps, 35; carbon-filament lamps, 51,825; metal-filament lamps, 189,848.

In the following table are given the detailed figures for the various classes reported. Corresponding figures are given for last January and for January, 1914:

Articles.	Jan. 1915.	Jan. 1914.
Batteries	$ 100,946	$ 43,892
Dynamos or generators	309,868	199,046
Fans	17,221	43,236
Insulated wire and cable	83,728	174,321
Interior wiring supplies, etc. (including fixtures)	72,104	46,452
Lamps—		
Arc	759	9,204
Carbon-filament	5,802	13,910
Metal-filament	38,504	21,840
Meters and other measuring instruments	40,556	
Motors	205,140	346,782
Static transformers	57,122	128,788
Telegraph instruments (including wireless apparatus)	17,326	12,788
Telephones	184,556	70,265
All other	640,306	837,122
Total	$1,773,938	$1,947,646

Rejuvenation at Dayton.

A very successful rejuvenation was held in Dayton, O., March 17, by the Dayton Jovian League, at which 25 candidates were initiated. The rejuvenation was preceded by a banquet at the Algonquin Hotel, attended by 250 Jovians. Many of those who attended the meeting of the Committee on New Business Co-Operation of the Ohio Electric Light Association during the day were present.

Frank M. Tait, president of the Dayton Power & Light Company acted as toastmaster and the following toasts were responded to: C. V. Hard, president of the Ohio Electric Light Association, "The Association;" W. W. Freeman, president, Union Gas & Electric Company, Cincinnati, "The Public Be Pleased;" H. M. Waite, city manager of Dayton, "The City Manager Form of Government;" S. G. McMeen, president Columbus Railway Power & Light Company, "Service First;" F. H. Rike, "The Greater Dayton Association;" D. L. Gaskill, secretary Ohio Electric Light Association, "The Small Central Station;" and A. E. Loeb, "The Jovian Order."

In speaking on the subject of "The Public Be Pleased," Mr. Freeman said there were two sides to the question. One is the fact that the company's conduct is of a caliber to please the public, and the second is the acknowledgment of this fact by the public. There are many difficulties encountered in pleasing all the public, but this is the aim of every progressive company.

The rejuvenation and banquet was in charge of Thomas F. Kelly, statesman for Ohio. The degree team is composed of W. B. Unger, Jupiter; K. W. Nocka, Neptune; H. E. Long, Pluto; H. H. Wollaston, Vulcan; J. A. Becker, Mercury; F. S. Breidenbach, Hercules; S. Perry, Mars; G. A. Gnau, Apollo, and G. B. Sayre, Avrenin.

Meeting of Radio Engineers.

Over 200 attended the March meeting of the Institute of Radio Engineers, at which Edwin H. Armstrong presented an interesting paper on "Recent Developments in the Audion Receiver." Mr. Armstrong described in detail the regenerative receiver with which his name has been identified and outlined its use both as an amplifier and a "beats" receiver for sustained waves. The paper was discussed by John Stone Stone, who spoke of some early work with amplifiers, and John L. Hogan, Jr., who gave the results of some comparisons of sensitiveness and reliability between a number of forms of heterodyne receiver, including the audion type.

At the next meeting, to be held at Fayerweather Hall, Columbia University, New York City, 8:15 p. m., April 7, Irving Langmuir will present a paper on "Applications of Thermionic Currents to Radiotelegraphy and Radiotelephony." Dr. Langmuir's work with thermionic currents in very-high-vacuum tubes is well known. He will outline the theory of such currents in these tubes, describe several pieces of apparatus which have been built for receiving radio signals, and also some devices for producing electrical oscillations and controlling them for radiotelephony.

Philadelphia Section Activities.

The Philadelphia Electric Company Section, National Electric Light Association, held its February meeting on Tuesday evening, February 16. A half-hour preliminary concert was given by the Section's Concert Band, under the leadership of J. G. Johnson. The speaker of the evening was Silas F. Neff, president of Neff College, who spoke upon the topic "Self-Building and a Successful Life." Following this the Entertainment Committee, under the able leadership of F. X. Monville, presented an elaborate vaudeville program which was much enjoyed by the 300 members who were in attendance.

A combination meeting of the Meter and Engineering Branches was held on February 2. The "Central Station Before and After the Advent of the Steam Turbine," was the subject of a very interesting illustrated talk by A. Lynn Ash. Charles Penrose was the second speaker and gave a most interesting description of the progress of the work at the new generating station "A-2."

It was announced at the joint meeting of the Commercial and Accounting Branches, that, on account of the similarity of their interests, they would hereafter join forces and be known as the Commercial Branch. R. L. Lloyd opened the meeting with a discussion of the Electric Vehicle Section of the "Electrical Salesman's Handbook," in which he pointed out the value of the data furnished for the use of electrical salesmen, and the accuracy and value of the tables in their application to the subject.

Jovian Prize Contest.

The Jovian Order, in its commendable effort to increase efficiency in the electrical industry, is conducting a contest, open only to Jovians, for articles on personal experiences in developing efficiency. Prizes aggregating $200 will be awarded for the best articles. The articles may refer to any branch of the electrical industry and to any department of the work. The awards will be made solely on the basis of practicability and value of the suggestions contained in the articles.

Salesmanship.

At the meeting of the Electric Club, Chicago, on March 18, an address on "Salesmanship" was made by H. R. Fogleman, of the Sheldon School of Salesmanship. Mr. Fogleman gave a very interesting and helpful address in which he analyzed the elements involved in success in life and in business building, and then pointed out the qualities necessary to achieve the greatest results in salesmanship.

Convention of Chemical Engineers.

The seventh semi-annual meeting of the American Institute of Chemical Engineers will be held in San Francisco, Cal., August 25 to 28. An itinerary is being arranged so that the interesting natural scenery of the West may be seen and also some of the more interesting of the typical chemical industries of California.

Convention Date Set for Electrical Engineers.

The annual convention of the American Institute of Electrical Engineers will be held at Deer Park, Md., June 29 to July 2. There will also be a meeting at San Francisco in September.

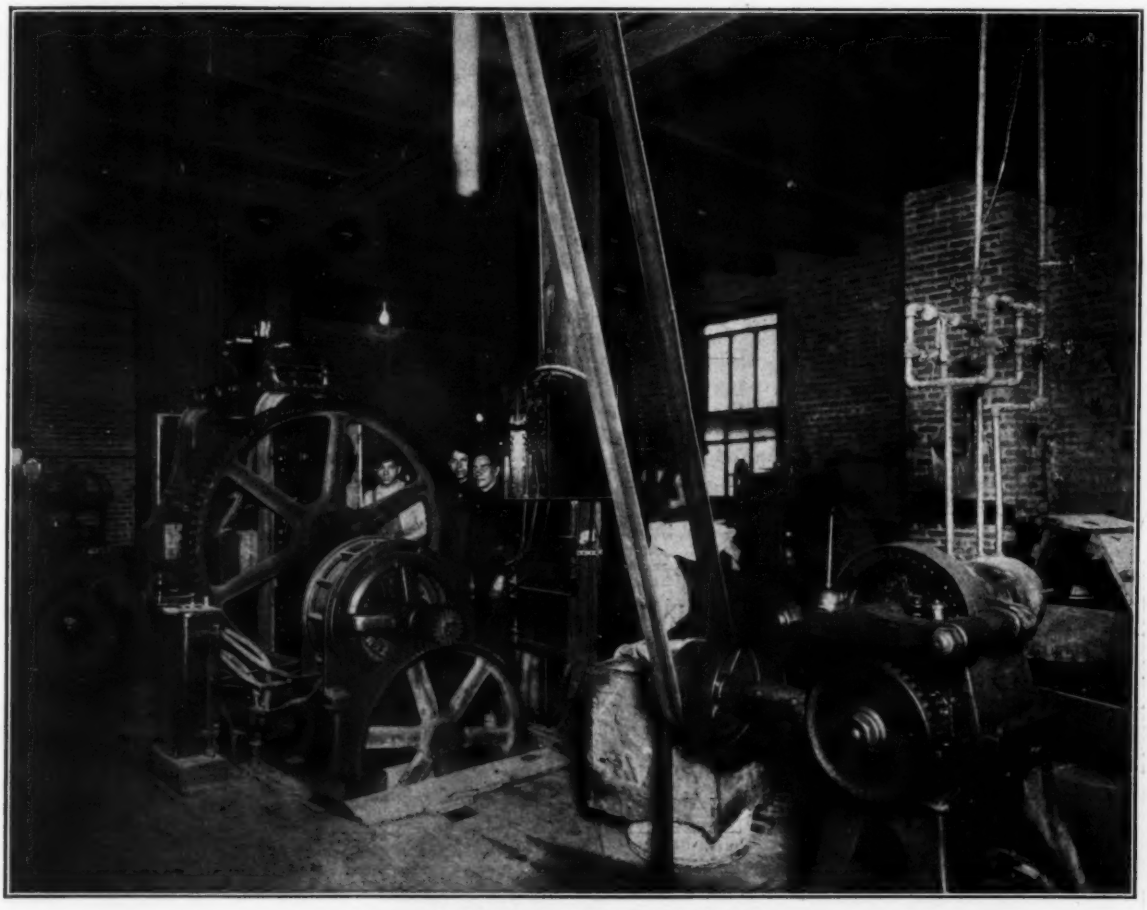
Electricity in Rubber Mills.

This article outlines the various processes involved in rubber working and discusses the characteristics of motor and control equipment best suited for the requirements. The various systems of electric drive for rubber calenders are analyzed and a full discussion given of the advantages and disadvantages of each. Direct-current motors are recommended, the energy to be supplied by a synchronous motor-generator set when power is supplied by a central station.

In considering the application of motor drive to rubber mills and calenders it should be borne in mind that there are several subdivisions of this industry. Some factories are engaged in the refining of crude rubber into a salable shape, such as those making the refined product into tires, tubing, mechanical goods, etc., and those engaged in the process of reclaiming scrap rubber, that is, taking old, worn-out articles of rubber and extracting the useful rubber remaining therein, to again be made up into the various manufactured articles.

In the various plants most of the processes involved are common, to a certain extent, but there are special conditions applying to each, and they must be studied separately when the installation or substitution of motors for the existing drive is contemplated. As it is necessary to use steam for some of the various processes of manufacture, the application or substitution of motor drive has only recently received its merited recognition, not only as a factor of economy, but also because it is generally found that the quality of the finished product can be bettered, as well as increasing the production, without any increase in manufacturing equipment. In addition to these features, motor drive gives a cleaner, more efficient and more flexible installation and permits of economy in floor space, at the same time giving a simple and easily handled layout. Power-consuming line shafting, that also affects the proper illumination of the work and introduces numerous complications, can be entirely eliminated and with it belts, pulleys, etc., always a source of trouble.

In common with most other industries where continuity of service is essential to production, such as the manufacture of window glass, paint, candy, etc., and where steam in varying quantities is necessary, there has been an unwillingness on the part of rubber manufacturers to change to motor drive, and especially to central-station service. But with the increasing efficiency of the central station and the reliability of its service, together with the manufacturing advantages that it is possible to realize, this objection is rapidly being overcome. Central-station service removes the responsibility of the power supply from the manufacturer to the power producer, and, in the case of new plants, decreases the



Group of Motor-Driven Machines in Rubber Mill.

initial investment necessary, thus leaving the capital free for use in other ways, or as a reserve. In cases where it is not considered advisable, from a cost standpoint, to use central-station power, and this is particularly true of large plants, where a considerable quantity of steam, both high and low pressure, is used for other purposes, it has, however, been found economical to make a central-station connection for breakdown service, and also for use during certain periods of the time, such as at night for overtime work, and for driving additional equipment that may be installed. Such service introduces central-station power, to a limited degree, and gives it a wedge whereby, in the course of time, its superiority as to efficiency, economy and reliability may have been demonstrated to such an extent that its use throughout may be not only advisable, but imperative.

Rubber Calender Gear-Driven by a 35-Horsepower Motor.

Rubber is manufactured for commercial use from the crude rubber as well as from scrap rubber.

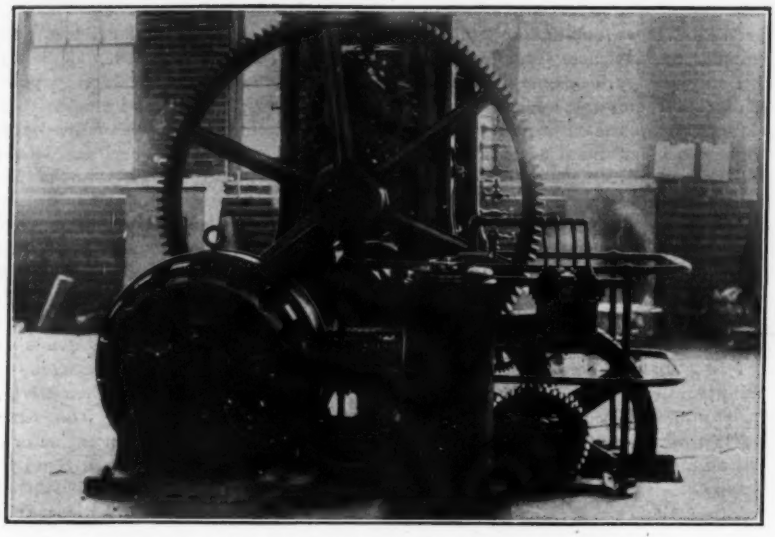
The principal sources of crude rubber are the wild trees of Brazil, although cultivated rubber, in increasing quantities, is now produced in East India, Ceylon, the Malayan Peninsula and Southern Mexico. The wild rubber reaches the factory in the form of balls or biscuits about a foot in diameter. Cultivated rubber is usually washed and sheeted at the plantation, and is shipped in the form of cakes of folded sheets.

These biscuits, as received, are first cut into pieces on a rapidly moving circular knife, with water running over it to soften the rubber. In the winter this water must be hot, so as to remove all frost. After cutting, the rubber is fed into a cracker or rough washing mill, consisting of two chilled-steel rolls, about 18 by 30 inches, grooved longitudinally with rectangular grooves and geared together to give different peripheral speeds to the rolls, in which the raw material is torn apart and rolled into a rough sheet. Water flowing around the rubber, in its passage through the rolls, removes a large portion of the entrapped dirt. This rough stock is then passed through a single set of rolls, where it is further washed and rolled out into sheets or "crepe."

After the sheeting or "crepe" has been properly dried in a steam-heated or a vacuum dryer, it is taken to the drug room, where it is proportioned with various ingredients, depending on its ultimate use. Some of the added materials increase the elasticity, some impart hardness and toughness, and some act as mechanical fillers, to cheapen the product without materially affecting the desired characteristics. After being properly mixed the rubber stock is allowed to season for 3 or 4 days before being put into warmers, where the stock is heated for use in the calenders.

Rubber Mixer Driven by a 35-Horsepower Motor.

Before scrap rubber can be manufactured into salable shape, it must be reclaimed from the old rubber boots, shoes, tires, etc., and a certain amount of pure gum must be prepared from the raw material for compounding with the reclaimed stock. As received, it is full of dirt and other refuse, which is removed by placing it in a tumbler, from which it is emptied into the crackers, which have two steel rolls, one corrugated and the other smooth. Here the scrap is chewed up into small pieces, but is still too bulky to be put into tires, for this stock, together with the fibrous materials, form a substance which is not easily reduced to a condition in which it can be used to advantage. Therefore, from the crackers the broken-up scrap is taken to a sulphuric acid bath, where it remains for 3 or 4 hours, the fiber being entirely removed. After being properly treated in the acid bath the stock goes to a tub washer, consisting of an elliptically shaped tub with a rotating paddle wheel on one side, and is here washed for an hour or more to remove the acid and other foreign matter from



Direct-Current Motor Geared to a Three-Roll Rubber Calender.

the stock. After this process has been properly completed the stock is taken to a devulcanizer, where it remains for from 24 to 36 hours. This devulcanizer is a large cylindrical iron tank, and after the stock has been placed in it the end is closed and steam admitted at a temperature of 350 degrees Fahrenheit.

In its essentials devulcanizing is the reverse of vulcanizing, which consists of subjecting the stock, which has been compounded and mixed with sulphur in the mixing machine, to a given temperature for a definite period of time, depending on its quality and the use to which it is to be put. At the temperature used in vulcanizing, some of the sulphur particles are converted into a vapor or gas, and combine with the rubber compound. By this process the rubber is hardened, toughened, made durable and vitalized. In devulcanizing a higher temperature is used, so that the sulphur is driven out of the compound, which is thereby reduced to a plastic form, without elasticity. From the devulcanizer the stock is placed in an open dryer with a temperature of about 120 degrees Fahrenheit. After it has become thoroughly dried it passes on to the grinder and sheeter, where it is pulverized, mixed with various compounds and run into sheets. After seasoning for several days it is heated in warming mills to prepare it for use in the calender.

Practically all rubber compounds, with the exception of those run through tubes, are sheeted in the calender. This machine consists of a number of steel rolls, from two to four in number, arranged vertically, connected by gears, so that the individual rolls may run at the same or different speeds, and through which the compound is passed to form a sheet. The surface of the rolls is finished smooth and the space between them is adjustable to a very fine degree. Fittings for steam and water connections, to heat or cool the compound, are provided.

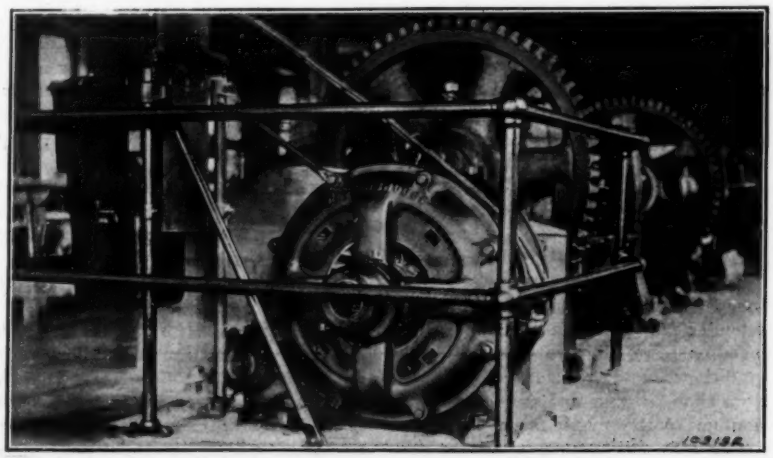
The calender performs the most important part of the work necessary in the manufacture of rubber goods, and is used for three general classes of work, namely, calendering or sheeting skim coating and frictioning.

Calendering simply consists of producing sheets of rubber of the desired thickness for some further operation. The stock merely passes through the rolls, coming out in sheets of different widths, depending upon the number of knives used in cutting. This stock is used for inner tubes of automobile tires, rubber treads, etc. In skim coating, the rubber stock is simply spread over the surface of cloth, or fabric, in a thin layer, and the resulting product is then used for carriage tops, automobile covers, etc. In friction work, the rubber stock is forced or rubbed into the fabric, so that the cloth is entirely impregnated with the compound, and may then be used for making automobile tires, rubber belts, etc.

In beginning the process known as calendering it is necessary that the speed be slow. This preliminary operation, which is known as threading-in, consists of cutting the rubber layer from the middle roll after it has been reduced to the desired thickness, and carrying the end of it to the reels. After this operation has been successfully completed the speed may be increased, depending on the nature of the product desired, but at no time should this speed be so fast as to prevent the operator from detecting flaws and imperfections in the rubber sheet coming from the calender. For frictioning and skim coating, the speed must be relatively slow, in order to reduce the danger of accident, and to enable the operator to properly start the coated or impregnated fabric on the reel. After this has been done the speed may then be raised to the desired operating point.

It has been found that different stocks and different classes of work can be most efficiently done at different speeds. The calender should, therefore, be operated at that speed which gives maximum output, compatible with the desired result, and a motive power that will give this result should be the one selected.

The highest speed that rubber compound can be forced through a set of calender rolls depends on the character and thickenss of the compound and the heat-absorbing capacity of the rolls. If the calender is driven too fast, the surface of the sheet blisters and tears and comes through rough, while if the calender is not driven up to the maximum permissible operating point, losses in production result. The proper speed is determined from experiment, and the permissible speed is gen-



Induction Motor Geared to a Rubber Mill.

erally higher at the start than after the rolls have become warmed up from use. Due to this heating in the process of manufacturing the finished product, the speed must be reduced somewhat to maintain maximum output and to keep the product uniform throughout. To obtain this result a fine speed gradation is therefore necessary.

The torque required depends upon the thickness and the material used, and there are so many combinations possible, together with a corresponding range of speed requirements, that it is difficult to formulate any rule to determine the power necessary. The motor must be large enough to meet the maximum condition. For a given drive and product the operation is practically a constant-torque proposition, although the torque required increases somewhat at speeds below 10 yards per minute. This decrease in torque is shown by the fact that at this low speed, and below, the horsepower does not decrease with the speed, as it theoretically should, in fact, in some processes, where this low speed is required, the increase in torque and horsepower are far in excess of what it would seem they should be.

If the calender is to be used for one class of work only, it is possible to select a speed which is very close to the maximum speed necessary, in which case the calender can be operated at approximately its maximum capacity. If, however, the work required of the calender is varied and single-speed drive is adopted, it would be necessary to gear the calender to correspond to the maximum operating speed at which the slowest compounds can be run, and this means a decreased production on all other compounds. Assuming that a comparatively small number of adjustable speeds are available, such as would be obtained from a multi-speed induction motor or from a mechanical speed-changing device, it would be possible to operate the calender at speeds very nearly suitable for the various compounds, but on those compounds, where a certain speed is just slightly too fast, a loss in production results from dropping to the next lowest speed. Besides resulting in a decreased production, such a condition also results in a lower labor efficiency and higher unit investment charges.

Where direct-current adjustable-speed motors are installed it is possible to adjust the speeds on all compounds at the maximum point. The calender can be driven at the maximum speed corresponding to the starting-up conditions, and the speed adjusted from time to time to keep the production up to the maximum point. The use of alternating-current motors necessitates the use of manual control, while with direct-current adjustable-speed drive automatic control and dynamic braking are possible in connection with push-button control. It is, of course, possible to provide these features with the alternating-current motor drive, but the cost is prohibitive and not easy to accomplish satisfactorily.

The production speed ranges of the finished article vary from a minimum speed as low as two yards per minute to a maximum as high as 45 yards per minute. With motor drive the speed ranges of the motor should be from 3 to 1 to 4 to 1, while as high as 5 to 1, and possibly 6 to 1, may be satisfactorily obtained. Such high ranges as the last mentioned are, however, not desirable from an operating point of view.

Calendering or sheeting rubber requires more power than skim coating or frictioning for given speeds. As frictioning is usually run at a higher speed than calendering, a larger motor is generally required. The power required for driving a calender increases as the distance between the rolls decreases, and this is especially noted when the stock is hard. It is due to the increased wedging action when the rolls are brought closer together. The power required on a given thickness of compound is fairly uniform, but the feeding of the compound introduces comparatively small variations in load. This variation in load with variable-speed drive causes a variation in speed, which in turn changes the thickness of the sheets rolled out. In friction work and in skimming where the fabric is placed between the rolls, it is impracticable to closely control the speed where this type of drive is employed. Furthermore, the efficiency with variable-speed drive is very poor compared to the combined efficiency of a direct-current motor with motor-generator set, especially when any speed reduction from the maximum is required.

Having discussed the conditions that must be met in order to insure economical and efficient operation in rubber calender work, a discussion of the relative advantages and disadvantages of the different types of drive available will be taken up. Three classes of drive immediately suggest themselves, namely, mechanical drive from line shafting, using either a steam engine or a constant-speed alternating-current or direct-current motor; adjustable-speed induction motor drive; and direct-current variable-speed and adjustable-speed drive.

Rubber Refiner Driven by a 35-Horsepower Induction Motor.

In small mills, or in mills where the range of production, and thus the speed requirements are small, a steam engine or a constant-speed alternating-current or direct-current motor can be used, giving, say, two speeds, the change from low to high speed being obtained by a clutch, the smoothness of acceleration, however, being dependent on the condition of the clutch and the personality of the operator. By allowing the clutch to slip the speed can be made slow enough for starting, or threading-in, and the rated speed of the shafting will be the operating speed for the average production desired.

The objection to this method of drive is that the operating speed is constant and fixed, and it often happens that

some stock should be run faster than the average and some slower, thus causing a loss in production and an inferior grade of calendered material. Inasmuch as the slow speed is obtained by allowing the friction clutch between the calender and the motor, or the driving and driven pulleys on the line shafting, to slip, it is far from efficient. When the calender is operated at a reduced speed for production purposes by allowing the friction clutch to slip, the amount of slippage must be manually controlled, and slight variations in speed are certain to occur, with the consequent effect on the production and the uniformity of the product. The starting of the motor is accomplished by means of a manually operated auto-starter, or compensator, or by push-button control with magnetic-type starter. Overload and

Group of Rubber Presses in Small Mill.

no-voltage protection is usually furnished, and push-button stations can be located for conveniently stopping the motor when desired, or in case of necessity, by opening the circuit in the no-voltage release. A mechanical brake provides the most effective means of stopping the motor, and should be located on the end of the motor shaft opposite the driving gear. It is not possible to stop the calender quickly in case of accident, by simply stopping the motor, on account of the belt slippage between the driving and the driven pulley, and this is a serious disadvantage. A double-throw switch can be provided for reversing the motor, but engine drive would be non-reversible.

This method of drive finds a limited application, and where the range of product is very great is not to be recommended. It will also be found that for the same output a smaller number of electrically driven adjustable or variable-speed calenders will produce better results and a greater output than is the case with mechanically driven calenders, thus resulting in decreased initial investment and lower unit cost. The ratio of calenders to engines for the same production is about three to four.

The second method of drive is obtained by means of the wound-rotor or variable-speed, slip-ring type of induction motor. The control for such an installation is usually obtained by means of a drum-type controller with sufficient secondary resistance to permit of a speed reduction to about one-third of the full-load speed. This reduction is necessary for threading-in purposes, and the resistance need be for intermittent duty only. The resistance should, however, be designed for continuous operation between 20 per cent below full-load speed and full-load speed.

Production by this method is limited, because although such a motor is fairly stable in operation to 50 per cent of ful speed, the speed regulation is poor, and the motor is very inefficient. A small speed range is economically permissible, but a reduction of from 15 to 20 per cent of full speed only is to be recommended, and even then the motor is less efficient than a direct-current motor operating under similar conditions. The poor speed regulation is due to the fact that the characteristics of the slip-ring type motor are similar to those of a direct-current motor when operating with armature control. The speed varies with the load and the operation is, therefore, very unstable and unsatisfactory.

Another method of alternating-current motor drive, with slightly greater flexibility than those before mentioned, is the use of a multi-speed or multi-frequency motor, or a combination of the two. Multi-speed drive is obtained by means of a change in the poles of the motor, using a switch which changes the primary connections. Two-speed motors are most commonly used, thus providing two operating speeds for the calender, the threading-in speed being obtained by means of a friction clutch. A futher refinement of the multi-speed application is the use of a multi-frequency supply, which can be, say, 25, 40, and 60 cycles. By combining the multi-speed application with the multi-frequency a still greater range can be obtained. Either of these methods separately, or the two in combination, give a more efficient arrangement with a much better speed regulation than can be obtained with the variable-speed slip-ring motor, but the principal disadvantage is that the different speeds are practically fixed and permit of no variation between the different ranges.

The control for each sperately, or for the two systems combined, can be either of the drum or magnetic-switch type, the idea being to connect the motor with the proper number of poles to the different frequency supply circuits in such a way as to obtain the desired speeds. There should be a sufficient time interval between the various connections to allow the magnetization of the motor to decrease to the proper value before making the next connection. This is particularly important when the drum-type controller is used, since the small space available may make it possible for one circuit to flash over into the other, in case the circuits are broken and made too rapidly. All installations of this type should be protected by an oil switch in circuit with the controller, the switch to be provided with overload and no-voltage coils. Push-button stations for stopping should be located convenient to the machine and used to open circuit the no-voltage attachment. All control should be reversible. Braking can be secured by means of a mechanical brake, as before described. In view of the foregoing discussion it will be seen that some more flexible and efficient method of calender drive is necessary to obtain maximum production at minimum unit cost.

The only remaining system is the direct-current method, which will be discussed as follows: (a) Multi-voltage. (b) Three-wire, double voltage.

(c) Buck and boost. (d) Adjustable motor.

(a) In the multi-voltage system the field of the calender motor is supplied with a constant voltage, and the armature is supplied with variable voltages produced by generators operating at different potentials, or by a rotary compensator or booster set, which will be discussed later. The former system is seldom employed, because a number of variable-voltage generators are required for each calender, thus making the cost prohibitive. The speed range by this method is wide, but can be accomplished in a much cheaper and more simple way by another method.

(b) A modification of the multi-voltage system, as mentioned above, is the use of a three-wire double-voltage circuit. This condition can be obtained by using a three-wire direct-current generator driven by a steam engine, and also by the use of a motor-generator set or a rotary converter. The last named method is most used.

The engine-driven three-wire generator is promptly eliminated from serious consideration, because in plants where motor drive is employed the majority of the installation usually consists of alternating-current motors, and, therefore, the source of supply, whether the current is generated locally or supplied from an outside source, will be alternating current.

The choice between a motor-generator set or a rotary converter is largely a matter of individual selection, rotary converters usually obtaining preference because of slightly lower first cost and higher over-all operating efficiency. The rotary converter requires a more skillful attendant than does the motor-generator set, especially if maximum corrective and compensation features in the supply circuit are to be realized, and it is also somewhat more complicated, due to the fact that the line or supply voltage is not suitable for use on the rotary converter, thus necessitating a change to the proper voltage by means of transformers. When the rotary converter is used three transformers are necessry, and are connected to the supply circuit for the purpose of obtaining this necessary voltage. A neutral point from the secondaries of the transformer bank is brought out to form the middle point of the three-wire circuit.

The control equipment for the three-wire system should provide easy and convenient means for changing over from the 230-volt circuit to the 115-volt circuit and vice versa, for reversing the motor, and for varying the speed of the calender. bv altering the resistance in the shunt field of the driving motor operating the calender. Drum-type manually operated control or magnetic control with a master controller may be used, the latter being preferable on account of better and more reliable operating characteristics. When the magnetic control system is selected the master controller is used for cutting out resistanee until a predetermined speed, depending on the setting of the master controller, is reached. This controller provides for the insertion of resistance in the armature circuit for starting, and gives ten points of speed control on the 115-volt circuit and ten points on the 230-volt circuit. Such an arrangement gives a 2 to 1 speed variation on the 115-volt circuit and a 2 to 1 speed variation on the 230-volt circuit, making 4 to 1 in all, with 20 to 22 points of control. The control equipment is full automatic, and provides for automatically starting and stopping the motor by means of conveniently located push-button stations, and which may be of any desired number, usually from four to six. The reversing, which is accomplished by means of a two-pole knife switch, is fqr use in case of accident, or the necessity of removing stock from the rolls. The master controller may be provided with a small "boss" opposite each notch, on which should be stamped the speed in yards per minute corresponding to that particular setting of the controller handle. A lock may also be provided, to prevent the operator from speeding up the motor, or from slowing it down, when a certain production is desired, and either of which operations might seriouly affect the quality of the goods and the production of the machine.

All motor equipments should be provided with dynamic braking obtained on one of the line contactors. This braking may be accomplished either by pushing one of the "stop" buttons at one of the push-button stations, which will automatically disconnect the motor from the line, or by simply moving the controller to the "off" position. The brake should be of sufficient capacity to bring the motor to rest immediately.

Speed ranges, depending on the finished product desired, may be obtained varying from 250/1,000 revolutions per minute to 300/1,200 or 400/1,200 revolutions per minute. It is not desirable to install a motor with such a speed range as to require any amount of operation by armature control, as such control is not only inefficient, but gives a spoor speed regulation, the speed varying directly as the voltage across the armature. To secure maximum efficiency of operation and production all speed variations should be obtained by means of shunt-field control, which gives good speed regulation under varying conditions, and all motors should be of the shunt-wound type.

Aside from the more or less complicated layout, due to the three-wire, double-voltage circuit, this system requires the use of a separate motor-generator set or rotary converter for each calender, unless the same grade of stock is at all times being worked simultaneously on the different machines. This system also implies the use of variable-speed motors.

(c) The so-called buck-and-boost system of speed control has also found application, but is not considered as reliable, efficient and economical as the system last described. In the buck-and-boost system, where a 250-volt calender motor is installed, a 250-volt direct-current motor-generator set is used, the field and armature of the booster motor being permanently connected directly to the 250-volt direct-current supply circuit. The booster generator armature is connected in series with the 250-volt supply circuit, and the armature of the calender motor. The fields of the booster generator, which should be of the shunt-wound type, are connected through a reversing switch to the 250-volt direct-current supply, so that they can be reversed, causing the booster generator voltage to buck or boost this supply voltage, as may be desired, thereby varying the voltage across the armature terminals of the calender motor, whose fields are permanently connected to the 250-volt direct-current supply. The speed of the booster set remains constant throughout, the speed variations of the calender motor being obtained by varying the field strength, and, therefore, the voltage of the booster generator, whether it is bucking or boosting, by means of a regulating field resistance. Push-button stations and dynamic braking should be provided for the calender motor, as described previously. The control can either be manual or full automatic, preferably the latter.

The principal objection to this system of speed control is the introduction of another element, the booster motor-generator set, which adds to the complication of the lavout. increase in initial cost, decrease in over-all efficiency and increase in cost of operation. When using purchased power the bill will be increased, due to the fact that power from rotary transformer, or from the alternating-current supply circuit, in addition to that needed for the calender motor. will be required to drive the booster set. A variable-speed motor is used in connection with this layout, and a separate booster for each calender is necessary. This system, in its essentials, is simply another modification of the multi-voltage system.

(d) The last method of direct-cur-

rent motor drive to be considered is that involving the use of the adjustable-speed motor. This application is similar to the multi-voltage or the buck-and-boost application, in that the armature voltage remains constant. The voltage supply for the field circuit, however, is not changed, the speed variation being obtained by means of an adjustable regulating resistance in this circuit.

With the more recent general application of commutating poles to direct-current motors greater speed range is permissible than has heretofore been the case, and it is this feature of design that has made possible the wide speed variation available in motors operating with constant armature voltage and varying field strength. This method, here described, results in the simplest equipment, as a whole, the entire range of speed control being inherent in the motor and its control equipment, and not in equipment external to it, as is the case in other applications mentioned. The motors that have been designed for adjustable-speed work show an efficiency almost as great on the low points of the speed curve as on the high points, and this is an item worth considering, especially when power is purchased. In order to obtain the wide, flexible range desired the motor must be larger, but it is, therefore, more substantial and rugged.

The control equipment for adjustable-speed operation is simple and reliable and permits of a finer and more extensive speed variation than is usually to be found in the systems heretofore mentioned. It consists of current-limit accelerating contactors, reversing contactor, overload, no-voltage and field accelerating relays, and dynamic braking features. Push-button stations, operating in connection with safety attachments on the machine, for quick stopping in case of necessity, are included. A master-control operating panel, mounting a reversing pilot switch, a push-button switch and the field-regulating rheostat, is provided for installation at a point convenient to the calender, and where the operator can closely observe the work. This is especially desirable in starting. From 20 to 30 operating points, as may be necessary, may be provided, and any number of push-button stations can be included. This master-control panel has a pilot switch with a contact arm which travels over approximately 360 degrees, and which is made long enough so that it can be closely set to any desired point, and is convenient and easy to operate. It is used instead of the master or drum-type controller, mentioned in describing the other systems of control.

Starting or stopping of the motor can be accomplished at any one of the push-button stations, or by opening an emergency switch, the motor accelerating, in starting, at a predetermined speed, the current flow being limited by the current-limit relays. This prevents abuse of the equipment on the part of the operator, and protects the motor and machine from excessive strains. In order to start again, after the motor has been shut down, it is only necessary to push the "start" button at the station where the motor was previously stopped. If the motor was stopped by opening the emergency switch it can be started again in the same direction by simply closing it. In case of an emergency stop the motor can be started up in the reverse direction by throwing the reversing pilot knife switch over to the reverse position, and the motor can then be started or stopped by this switch only. This safeguards the operator, and prevents the motor being started by some one other than the operator. In case the emergency switch has been opened to stop the motor it can, nevertheless, be started up in the reverse direction with the reversing pilot switch without again closing the emergency switch. This obviates loss of time, as well as preventing the motor being started again in the same direction, and it is quite an efficient safety device, and about as near foolproof as such a control can be made. Dynamic braking is also provided for quick stopping, thus preventing the motor from coasting, and effecting a saving in material being fed into the calender.

Because of their ability to handle high load peaks, the majority of the motor equipment in a rubber factory will be alternating current, and it is, therefore, advisable whether making or purchasing power to use a synchronous motor-generator set or a rotary converter to supply the direct-current circuit of the calender motors. For the adjustable-speed motor, a single voltage supply only is necessary, and this direct-current circuit will, therefore, be 250 volts.

While installations using alternating-current motors for driving all of the equipment may be less expensive initially, it will be found that the use of direct-current motors, with necessary rotary transforming equipment, for calender drive, will give a more efficient and reliable plant and a larger output with corresponding decreased unit costs. Less stock will be lost and a more uniform product will result. One rotary transforming equipment can be installed to operate all of the calenders, thereby reducing the transformation losses and the initial investment.

Automatic alternating-current motor-control equipment being prohibitively expensive, and, therefore not used, alternating-current motor equipment does not provide the safety features that are obtained with the direct-current motor equipment. The use of sychronous converter equipment also provides corrective power-factor features that result in decreased power consumption and increase the capacity and over-all efficiency of the power-supply cicuit. As it is the general practice of central stations supplying power to give an additional discount for the use of power-factor correcting equipment, this feature may be found to effect a sufficient saving, not only at the set, but also in increased capacity of transformers and lines, and in improved over-all efficiency of the motor equipment, to more than pay the overhead charges on the rotary transforming equipment.

The direct-current motor drive gives an equipment that is simple, flexible and reliable. It operates at maximum efficiency for all classes of work with an accompanying constant, unchanging rate of production for the several products worked.

Accounting Night at Allentown.

C. M. Walter, auditor of the Lehigh Valley Light & Power Company, and of the Lehigh Valley Transit Company, delivered a very interesting address before the members of the Lehigh Valley Light & Power Company Section of the N. E. L. A. at the March meeting held in the Assembly Hall at Fairview, Allentown, Pa.

Chairman Irving Samuels introduced the speaker and in the course of his remarks referred to the fact that Mr. Walter has been connected with the company since 1894 with the exception of a period of 18 months. During this interval of 21 years, the company has expanded throughout a wide range of territory and the revenues have been increased seven-fold.

Mr. Walter took as his subject, accounting, as it relates to modern business conditions. He stated that the method of accountants was as old as civilization and had advanced in the same degree as man had advanced from his earliest periods. At the present time the larger business interests, which have come under the eye of the interstate commissions and public-service commissions, are required to keep their accounts in such shape that at any time the officers can give a comprehensive statement of their affairs, should the occasion arise. These reports must be clear and concise and cover the business thoroughly.

Electric delivery wagons which are used by restaurants and caterers are equipped with electric heating devices to keep food hot in transit.

Commercial Practice
Management, Rates, New Business

Successful Meeting of Ohio New-Business Men.

The growing importance of the frequent conventions, held under the auspices of the Committee on New Business Co-operation of the Ohio Electric Light Association is indicated by the attendance and interest at these meetings, which are held solely for the purpose of discussing topics of interest to commercial men of central stations. A new record was established by the meeting held at the Algonquin Hotel, Dayton, Ohio, on March 17, at which 112 were present, representing a majority of the central-station companies of the state.

The delegates were welcomed to Dayton by Frank M. Tait, president of the Dayton Power & Light Company, who was introduced by Thomas F. Kelly, chairman of the Committee. Mr. Tait spoke of the growing importance of commercial-department work in central-station activities, and the benefits that can be derived from frequent meetings and discussions.

A paper was then presented by E. R. Kelsey, advertising manager of the Toledo Railways & Light Company, entitled "Central-Station Advertising."

This paper deals with advertising in the broad sense. It is pointed out that there are still many who consider electricity a luxury and educational work is necessary. The satisfied customer is the best advertiser any company can have and therefore service must be set at a high standard. Particular care must be exercised in selecting the employees who come in contact with the public as the opinion formed by a customer of the company is based largely upon the impression made by the employee. Handling complaints requires much diplomacy and tact. The greatest asset of a public utility company is the friendship it cements by faithful service and this is impossible without the co-operation of every employee.

Mr. Kelsey held that newspaper advertising is the most effective for central stations. Greater attention should be given the preparation of copy. Every new-business manager should be an advertising man and he should be enough of a salesman to put his personality into print. Illustrations are recommended for advertising copy as well as testimonials by satisfied customers. Booklets, circulars, cards, etc., should supplement newspaper advertising. Care should be exercised in compiling a mailing list. Backs of monthly bills should also be utilized for timely announcements. Street-car posters and an electric sign are also recommended.

The paper cautions against forcing advertising matter in the news columns of the local dailies. Publicity in the news columns will come naturally as a result of the progressiveness of the company. The utility should stand for construction in the community and take part in civic work.

The advertising value of electric signs is discussed and it is pointed out how this business can be increased by selling electrical advertising service at a definite rate per day. This, of course, includes the sign installed, energy, renewals, cleaning, etc. Various other features of advertising are treated, such as follow-up systems, etc.

The discussion was opened by H. M. Lytle, of Piqua, who gave an illustration of the results of modern advertising and publicity methods. When the franchise at Piqua was obtained by the Dayton Power & Light Company conditions were extremely bad, and there was much antagonism shown by the people toward the company. The first step taken by the new management was to have representatives of the company personally visit every customer and explain that considerable money was to be spent in improving service and getting in closer touch with the customers. As a result of this activity, the request of a competing company for a franchise in the city was rejected.

Thomas F. Kelly made mention of several letters from satisfied customers, which were framed and hung in the Dayton company's offices, where they could be read by all who entered. He thought that the influence of these letters was noticeable.

E. R. Kelsey urged that central stations make use of the literature which is supplied without charge by the various manufacturers. This literature is usually of a character that would be impossible to obtain if the preparation was undertaken by the individual companies.

George Williams, of New York, stated that the properties operated by Henry L. Doherty were all provided with cabinets in which to display to advantage the various booklets distributed by the manufacturers. He advocated extensive advertising and thought that sales managers of central stations should demonstrate their sales ability by obtaining as large appropriations as possible from the general managers of their respective companies for this purpose.

C. E. Yacoll, of Youngstown, referred to the success which was had from a "Made in Youngstown" exhibit conducted in the lighting company's display room. Subsequently one of the show windows was permanently given over to power customers of the company, and they are permitted to exhibit for a specified length of time goods made with the use of electric power. He thought this form of advertising of benefit, both to the central station and the customer, as in one case a customer increased his motor installation 100 per cent as a result of orders and inquiries following the display of his goods in the company's window.

Thomas F. Kelly referred to the activities of the Dayton Advertising Club in exhibiting modern methods of advertising. A store has been fitted up with all advertising devices made in Dayton, and the lighting company is demonstrating proper show window, store and sign lighting.

At this point adjournment was taken for luncheon, at the close of which R. H. Grant, sales manager of the National Cash Register Company, delivered a very interesting address on "Salesmanship." Mr. Grant said there were three principal steps in making a sale: (1) Approach. (2) Interest. (3) Closing sale. He advocated two preliminary steps, namely, an investigation, to determine the condition of the prospect's business, and, secondly, preparedness. The salesman must outline the proposition in his own mind, and prepare his arguments in a consecutive and forceful manner before approaching the prospect. Mr. Grant said that it is impossible to divorce the human element from a sale, and that the successful salesman will also study the character and personality of his prospect.

He thought that appeal to reason and suggestion were both important,

and the engineer usually is lacking in his ability to close a sale after presenting the bare facts, because of his lack of persuasiveness and his inability to make suggestions that would influence the actual closing of the transaction.

Mr. Grant said that in selling lighting, all non-users must be considered as potential prospects. There are, however, little barriers that prevent the actual sale, and these must be investigated by the salesman.

At the afternoon session a paper entitled "Application of Electric Drive in Woodworking Shops and Disposal of the By-Product," was presented by J. F. Jones, of St. Louis. This paper reviews the advantages of individual drive and points out the instances in which group drive may be preferable. The latter offers the advantage of lower initial cost. Individual drive, however, offers compactness, safety, effective control, and general over-all efficiency by virtue of the reduction to a minimum of slippage in belts and transmission losses. Considerable mention is made of blower installations for woodworking plants, and it is stated that these consume from 50 to 60 per cent of the total power used during the month. It is urged that all intake and discharge pipes be carefully put together, or the efficiency of the equipment will be materially reduced. Data are given on the methods for determining the power required, and the size of the equipment needed for a given blower installation.

In regard to the disposal of the refuse from woodworking plants, the paper suggests several methods which have been successful in various parts of the country. These include selling shavings to pulp mills; sawdust to city fire departments; small pieces may be baled and sold for kindling; oak refuse may be sold to bakeries, etc. A rather unique method of disposing of the by-products that is used by some companies is described. This comprises mixing shavings with iron and steel filings, and sprinkling with salt water. An oxide is formed which is very useful and in demand by gas companies. It is stated that iron and steel filings cost about $5.00 per ton, delivered to the woodworking plant. The function of the shavings is to offer a large and useful surface upon which the iron oxide is formed. The paper concludes with tabulated data on the horsepower required for various woodworking machines.

O. E. Oltz, of Hammond, Ind., opened the discussion by inquiring if it was possible to ship refuse to foreign markets at a profit. R. A. McGregor, of Toledo, mentioned several plants where this is being done. It depends, he said, on the distance the refuse is to be shipped.

F. B. Steele, of Dayton, mentioned two woodworking plants which are purchasing power from the Dayton Power & Light Company. The refuse in both instances is used entirely for dry-kiln work. Group drive is used in both installations, and Mr. Steele thought that greater economy could be effected in these two plants if individual drive were adopted.

D. O. Vaughn, of Union City, took exception to a statement in the paper that it was possible to sell the refuse for fuel. He thought this would tend to discourage the use of central-station power, as a manufacturer would question the economy of selling fuel and buying power.

C. E. Yacoll, of Youngstown, stated that 13 of the 18 woodworking plants in Youngstown purchase power from the central station. There are various local uses for the refuse where this is in excess of the company's own demands for dry-kiln work. One manufacturer disposes of the shavings to a hinge manufacturing company, which uses them to absorb oil in the tumblers.

J. R. McCoy, of Columbus, referred to an installation in a box factory where the revenue from the refuse pays for the power consumed.

R. A. McGregor, of Toledo, discussed blower equipments in woodworking plants, and thought that the installation of individual blowers or one central blower depended upon local conditions, and also upon the personal views of the engineer. He described a method of reducing the energy consumption of a blower system in one large plant which previously had used a central blower. Blower connections from many of the machines were eliminated, as these were found unnecessary, and the refuse which accumulated on the floor was at periodic intervals dumped into floor pockets and removed by means of a second blower operated only at these periods. This arrangement permitted two smaller blowers to take the place of the one large one which operated continuously.

H. O. Loebell, industrial heating specialist, for the Doherty properties, spoke of the growing importance of industrial electrical heating and the need for an association which would consider this subject solely. He stated that electric heating offers tremendous possibilities far in excess of industrial power. Electrc heating has an almost perfect power-factor, and is usually an off-peak load. From the standpoint of the customer, it is safe, easily controlled, and economical. Oxidation is eliminated and the product much improved. He stated that the new process for making gasoline eliminates fuel oil, which is now the principal fuel used in the metallurgical industries. This makes the campaign for heating business particularly timely.

A. K. Young, of Toledo, also spoke of the importance of industrial heating to the central station, and issued an invitation to all interested to attend a preliminary meeting, to be held in Toledo on May 1. At this time, Mr. Young stated, he hoped to be able to show those attending an installation of industrial heating aggregating 15,000 kilowatts.

W. H. Patterson, of Pittsburgh, then presented a paper entitled "Co-operation of the Electric Motor Manufacturer with Central Stations to Secure Available Power Business." This paper outlines at some length the opportunities existing for co-operation between the motor manufacturer and the central station in securing power business. The manufacturer has made available for general use a considerable amount of data dealing with the application of electric motors to various industries which should be of assistance to power salesmen. Supplementing this, there have been published general articles dealing with motor applications in specific industries, together with general publications to be issued by central stations in securing power business. The salesmen and engineers of the manufacturing company are always willing to give personal aid to the power salesmen of the central-station company, and in addition the manufacturers develop capable power salesmen who can be employed by the central stations for any length of time, and when their services are no longer required they are returned to the manufacturer. Finally, the manufacturers co-operate, by their willingness to develop apparatus which is necessary to supply the needs of some special application.

In the evening, the delegates attending this meeting were present at a rejuvenation of the Jovian Order, held by the Dayton Jovian League. An account of this affair appears elsewhere in this issue.

Extensive Campaign Inaugurated to Increase Output in Boston.

The Edison Electric Illuminating Company of Boston is conducting a publicity campaign throughout its territory, with the slogan, "Electricity for Everybody." Representatives of the company located in the several districts, aided by a large corps of men, will call on every resident and explain the varied uses of electricity. People now using the Edison Company's service will be called upon and asked if the service is in every respect satisfac-

tory, if proper illumination is being enjoyed, and if each person is using the electric service available through domestic appliances he has on hand.

The undertaking is a gigantic one, as it involves travelling over every highway and byway of the 42 cities and towns in the company's territory. This means thousands of miles of travel.

Ice-Making as a By-Product of Central Stations.

At a dinner and meeting of the Chicago Section of the American Society of Mechanical Engineers, held in the Hotel La Salle, Chicago, on the evening of March 19, refrigeration was the subject of several addresses by experts on this matter, special reference being made in some of the talks to ice-making as a central-station by-product.

Heywood Cochrane, of the Carbondale Machine Company, was the first speaker. Except in large cities, where the cost of distribution requires many plants located close to their ice-consuming districts, it is more economical to have an ice plant as an auxiliary adjacent to the central station than to have isolated motor-driven plants. Mr. Cochrane described and compared the characteristics of the compression and absorption ammonia processes. The power requirements of the latter are very small, only about one-twentieth horsepower per ton of refrigeration being required for pumping. Exhaust or live steam is necessary, about 55 to 60 pounds of steam per ton of ice; the absorption process also needs somewhat more water than the compression process. It is particularly adapted for low-temperature refrigeration. A combination absorption and compression plant can under certain conditions yield the highest economy.

Mr. Cochrane described an ice-making auxiliary plant operated by a southern central station that was recently changed over to the absorption process. The ice plant remained in its former location and was supplied from a new generating station 500 feet away. After the changes were made it was found that the cost of making ice was reduced from the old figure of $2 per ton to 43 cents and as low as 41 cents per ton. This plant has worked very successfully and is a very profitable one.

If properly designed and operated with reasonable intelligence, a central-station auxiliary ice plant may prove to be more profitable than the electric plant itself. In fact, such an ice plant may change an unprofitable electric plant into a remunerative one.

Otto Luhr, consulting refrigerating engineer, made a general address on refrigeration in which he explained in a simple manner the fundamental principles of the subject. A refrigeration system should be regarded as the reverse of a heating system. The requirements of an ideal refrigerant were defined. Mr. Luhr has found many operators who evidently knew little about the fundamentals of the process. It is important that only skilled operators be put in charge of any plant. It is also important to use good boilers, pumps and other auxiliaries in order to obtain high efficiency from each part of the plant; the compressors are usually given most of the attention and the auxiliaries neglected.

Mr. Luhr said that all of the various refrigerating processes can be used more or less interchangeably, but each has its own special field in which it will give higher economy or better all-around results than any other.

Fred Wittenmeier, of Kroeschell Brothers Ice Machine Company, dwelt particularly on the carbon-dioxide process. This is under normal conditions fully as efficient as the processes using ammonia or sulphur dioxide. Because of the practical absence of danger connected with its use, it is especially suitable for installation in restaurants, hotels, deep basements, ships, and for cooling auditoriums. Data on a plant for cooling a large church were given. This process can be used without requiring brine. Leakage of carbon dioxide gas is not troublesome compared to ammonia.

E. W. Lloyd, contract agent of the Commonwealth Edison Company, explained how this central station had in the last few years acquired considerable ice-plant load. This has steadily increased until now there are 18 electrically driven ice plants on Edison service; these make about 10 per cent of all the ice used in Chicago. In cities where the water supply is of good quality there is a strong trend toward the manufacture of raw-water ice, since this dispenses with the need of steam for producing distilled water. An electrically driven plant can be located at or near the center of its distributing district and the cost of distributing ice in an area of several square miles is thus brought to a minimum.

The operation of the electrified Chicago ice plants has been studied carefully to observe results and develop methods for improving the economy and the product. Various schemes are being worked out to solve the air problems. It has been found that the load-factor of these scattered plants is not as high as was expected, this being not over 45 per cent annual load-factor in some plants. The kilowatt-hour consumption per ton varies in different plants on account of the varying conditions in different cases. Where electric driving is used, a close study of the various losses can be made because the electrical measurements are of high accuracy. Data are being obtained on the origin of these losses and on the influence of various factors on the plant efficiency.

In Chicago about 7,000 horsepower of electric power is supplied to the ice plants at a rate approximating one cent per kilowatt-hour. This low rate is given because the load is highly advantageous for the central station; the demand is highest in summer when the electric load on the system is lowest.

Gardner T. Voorhees, consulting refrigerating engineer, made the final address, which was illustrated by experiments and lantern slides. He said that compressing machinery has not been improved very much. He then described the multiple-effect compressor device which he invented and which gives great increase of compressor capacity and economy.

Income from Refuse From Box Factory Pays for Power.

The Rood Box Company, of Columbus, Ohio, which purchases power from the Columbus Railway, Power & Light Company, manufactures wood boxes of all description and uses soft, air-dried wood exclusively. The machines are all motor driven and the motors aggregate 200 horsepower. The monthly consumption is about 8,500 kilowatt-hours. Part of the shavings and all of the wood trimmings are burned under the boiler which supplies steam to the dry kilns. This plant uses no kiln-dried lumber but dries lumber for other concerns. The company charges $4.00 per 1,000 feet of lumber dried and about 15 days are required for drying.

The excess shavings and sawdust are passed through a conical screen located directly under the cyclone. The shavings and sawdust have a whirling motion as they pass through this screen and the sawdust is forced through the mesh and the clean shavings drop through into a separate storage bin. The shavings are made up into bales of 80 pounds each, the sawdust is sold by the wagon load. The income from the sale of refuse amounts to $200 per month. About one-third of this amount comes from the sale of sawdust, the remainder from the shavings.

The baled shavings sell from 22.5 to 25 cents per bale and are used for packing purposes and bedding. The breweries use a large amount of shaving for packing bottled beer in the winter time to prevent freezing. It costs about 3 cents per bale to bale shavings.

The sawdust sells for $2.50 per wagon load and is used by paint manufacturers for packing and for insulating refrigerators and for bedding.

The income from this refuse practically pays for the power used in the plant.

Electrical Construction

INTERESTING CONDUIT INSTALLATION IN GAS-ENGINE FACTORY.

Plant of Woodward Motor Company.

In wiring a factory for light and power, it is altogether too common a practice to provide the least possible equipment in the way of circuits and outlets that will meet the immediate requirements. This greatly hampers the electrical operation of the shop by preventing the full achievement of those economies and conveniences that electric driving and lighting brings about. A more serious difficulty that results from this practice, however, is that as the shop grows the likelihood of improperly made extensions, of overloading of circuits, excessive fusing, etc., greatly increases.

In contrast to this practice, there has recently been completed the wiring of a Chicago factory in which most liberal provision was made for greatly increased use of electric light and power through future development of the business. This installation is also a very good example of all-conduit wiring.

The plant referred to is the two-story factory of the Woodward Motor Company, 7310 South Chicago Avenue. This company manufactures a very simple and highly efficient type of gas or gasoline engine, known as the Woodward slide-valve gas engine, and designed for use in automobiles and motor boats, as well as in stationary plants. By means of an ingenious slide-valve construction this new type of engine eliminates the difficulties connected with the ordinary poppet valves, has fewer parts, is lighter in weight, noiseless in operation, and is capable of higher speed and better speed control. The first floor of the building is for heavy machinery, and for assembling and shipping; the second floor is used for the lighter machine tools and for bench work.

Service is obtained from the Commonwealth Edison Company's three-phase lines, through three separate service circuits brought directly through the wall to the large combination service, metering and distributing board shown in Fig. 1. One of these circuits is for power, another for regular lighting, and the third (from another line) is for emergency lighting supply in case any trouble should develop on the regular lighting circuit.

The largest cabinet on this board is for the power circuits, which are all

Fig. 1.—Service, Metering and Distributing Board in Plant of Woodward Motor Company, Chicago.

220-volt, three-phase. The main power service switch is of 200-ampere rating. After passing through the meter, the main power circuit runs back to the same cabinet where, above the main switch, are the 12 branch-circuit cutout blocks, of which 11 are five horsepower each, and are connected through conduit to the several power cabinets about the building.

The cabinet for the regular lighting has a 100-ampere switch, protected by fuses both on the service and building side. After connecting the maximum-demand and watthour meters, the circuit is brought back to the branch blocks in the upper part of the cabinet. The largest of these, a triple-pole block, leads to another lighting cabinet on the second floor. The smaller two-pole blocks are for six regular lighting circuits on the first floor. Control for these latter circuits is by means of push-button switches arranged in an eight-gang box beneath the cabinet; two extra switches were provided to permit subdivided control on some of these circuits. The small cabinet at the right contains the service switch for the emergency lighting circuit, for which the small meter is connected.

Fig. 2.—One of the Motor Switch Cabinets and Wall Lighting Outlets.

The three-phase power circuits are run in conduit along the ceiling of the first floor, and six of them are carried to outside-wall pillars where they are brought down to the motor switch cabinets. From this the circuit is carried down to within one foot of the floor, where it terminates in a three-pole Unilet terminal and then runs in open wire to the adjoining motor. One of the reserve motor cabinets and circuit terminals is shown in Fig. 2. Where the motors are distant from the wall, the conduit is run close to the motor, of

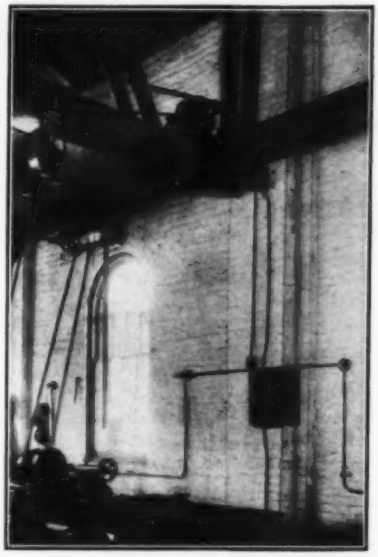


Fig. 3.—Motor Installation, Second Floor.

course, and the switch box placed there also. On the second floor the machinery is mostly driven on the group-drive plan with motor mounted above and close to the wall. The motor circuit in this case is brought up from the ceiling of the lower floor and passes through the switch cabinet to the motor, as shown in Fig. 3. For the most part the motors are of one and two horsepower, so that a special starting box or compensator is dispensed with.

In both Figs. 2 and 3 are shown some of the side-wall outlets of the regular lighting circuits, and in each case a single emergency lighting outlet close to the motor switch cabinet. These regular wall outlets are very handy for bench lighting, as well as for connecting up portable lamps and small portable tools, such as electric drills, grinders, etc.

The lighting cabinet for the second floor is near the office and is shown in Fig. 4. Provision is now made for eight branch circuits. A cutout block for two additional circuits may be added in the reserve place in the upper part of the cabinet. The present circuits are controlled by push-button switches in the adjoining eight-gang switch box; two additional switches may be added here by merely removing the cover plates. At the left of this cabinet is a small bell-ringing transformer for operating the various bells and buzzers about the establishment.

For the general lighting there is installed in the middle of the ceiling of each of the large rooms on the first and second floors a line of 150-watt lamps with Hubbell enameled-steel reflectors. Individual tool lighting and bench lighting is by means of drop lamps. Engines are tested by driving a generator to which a lamp load is connected; for this purpose a large lamp bank has been installed.

Throughout this installation iron conduit, made by the Western Conduit Company, was used. Appleton Unilet angle and outlet-box fittings were used. All of the wiring, except placing of the meters, was done by the Oakland Electric Company, 6632 LaFayette Avenue, Chicago.

Convention of the Tennessee Electrical Contractors' Association.

The fourth annual convention of the Tennessee Electrical Contractors' Association was held in Nashville, on March 15, at the Tulane Hotel. Many members attended, particularly from Memphis and Chattanooga. A number of manufacturers' and jobbers' representatives were also present. President W. C. Tupper, of Memphis, presided. The program was carried out as per schedule.

Among the proceedings of interest to the general trade was the consideration and adoption of a resolution requesting the lamp manufacturers to adopt a uniform price for resale of Mazda lamps

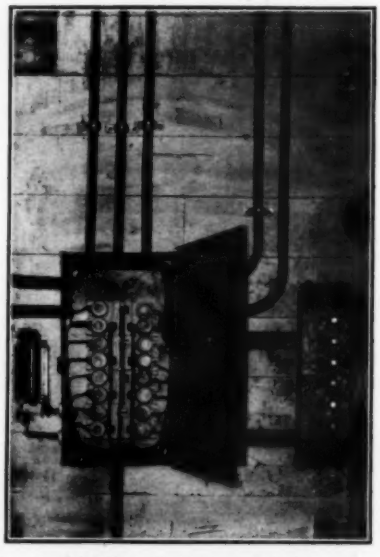


Fig. 4.—Lighting Cabinets, Switches and Bell-Ringing Transformer.

of 60-watt size and lower. Endorsement was voted of a pending state bill to require the separate letting of mechanical equipment from the general contract on all state, county and municipal work.

The following officers were elected for the ensuing year:

President, James A. Shingleton, Nashville.

First vice-president, F. H. Cantrell, Chattanooga.

Second vice-president, S. P. Watson, Knoxville.

Third vice-president, H. G. Street, Memphis.

Secretary and treasurer, J. A. Fowler, Memphis.

National director, W. C. Tupper, Memphis.

Chattanooga was selected as the meeting place for the 1916 convention. One of the interesting events of the meeting was the visit of the delegates to the Hermitage, the old homestead of President Andrew Jackson.

William R. Herstein, representing the principal jobber of the state, the Electric Supply Company, of Memphis, was present with several of his representatives and Mr. Herstein gave an instructive talk to the convention on the subject of "Accuracy in Determining Overhead Expenses."

J. P. W. Brown, superintendent of the Nashville Railway & Light Company, made an address at the opening session of the convention on "Co-Operation Between Central Station and Contractor." Mr. Brown told of the progress his company had made in this direction and pointed back to the time when the central station had maintained its own wiring department, doing work at cost and below and how it then looked on the contractor as an unnecessary evil. He said that he was now happy to say this condition had long passed into history and that the contractor was now regarded by his company as an important factor in the load development in Nashville. He outlined the policy of his company in its old-house-wiring campaigns, stating that this work was accepted at prices suggested by the contractors and then turned over to them, the consumer paying on the usual extended-payment plan. That this co-operation had succeeded had been proven by the fact that over 1,100 old houses were equipped during 1914, giving to the contractors more than $15,000 in business from this source. Mr. Brown's address was one of the signals of the new order of things which is coming into being between these two branches of the electrical industry throughout the country.

R. C. Leonard, statesman of the Jovian Order for Tennessee, gave an instructive address on "Practical Jovianism." He stated that Jovianism was nothing if not practical. The recent years have demonstrated its great value to the industry from a commercial standpoint. He pointed out that Tennessee had presented two of the seven electrical shows given during 1914. That it had joined for mutual welfare in Tennessee not only the contractor and the central station, but added to them the telephone, railway and inspection departments and that the "Altogether" slogan had found a real place in the sun. He also told of the great interest the newspapers were taking in the growth and influence of the Order. He called attention to its growth as being characteristic of the electrical industry, a new and an amazing development every day.

The Jovian League of Nashville received the appreciation of the convention for the delightful manner in which it took care of the entertainment of the delegates. Again was demonstrated the fact that no gathering of electrical men can be made entirely successful without the co-operation of Jovians who take as a matter of course the responsibility for the sunshine of the occasion.

The rejuvenation by the Nashville Jovians was unusually successful and the joviation which followed at the Tulane Hotel was a very enjoyable affair attended by about one hundred.

Cost of Wiring and Conduit Work.

The following power-plant cost figures are something different in figuring labor costs. Table I was made up after many cases were tried out in various parts of the country. In using it all expensive fixtures, apparatus, etc., are not included. The per cent is based on the actual wiring materials, including switches, fuses and cutout boxes. The same figures apply to lead-incased wire, No. 6 and smaller. Tables II and III explain themselves.

TABLE I.—ELECTRICAL LABOR COSTS FOR STATION WIRING WITH RUBBER-COVERED COPPER WIRE.

Size of wire.	Cost of labor; per cent of cost of material.
No. 14	100
No. 12	100
No. 10	80
No. 8	60
No. 6	40
No. 4	30
No. 2	25
No. 1, 1/0, 2/0, 3/0	20
No. 4/0 and cables	18

Table II gives the cost to install wire and cable in conduit. This price, one that would be used for such purpose as appraisal, includes: material, labor, a contractor's profit and overhead expense. It will cover feeders, and branches in the usual building work. This should not be used for short lines having numerous outlets.

TABLE II.—COST FOR PULLING WIRE IN CONDUIT.

Description.	Dollars per foot.
500,000-C.M. cable in 3-inch conduit	1.820
Two 300,000-C.M. cables in 2.5-inch conduit	1.210
Two No. 2/0 wires in 2-inch conduit	0.820
Two No. 1/0 wires in 2-inch conduit	0.620
Two No. 1 wires in 1.5-inch conduit	0.510
Two No. 5 wires in 1-inch conduit	0.250
Two No. 6 wires in 1-inch conduit	0.210

The average cost of all conduit bends in general wiring practice shows that from 20 to 50-degree bends cost very closely the same and that above 50 up to 90-degree bends cost a larger amount. It has been found that the cost of bending is a function of the diameter and in the usual lengths independent of the length of conduit being bent. The following table gives the labor charges to be added to the cost of the conduit. These costs are for field bending and are quite high when the diameter exceeds about two inches. In figuring conduit bending to be done on the job, list all bends to be made under two heads, 90 degrees and 22.5-45 degrees. Neglect all bends of less than 22.5 degrees and use about twice the 90-degree price for bends greater than 90 degrees.

TABLE III.—COST OF BENDING CONDUIT.

Size of conduit in inches.	——Dollars per bend.—— 90-degree bends.	Bends from 22.5 to 45 degrees.
3	1.000	0.900
2.5	0.750	0.600
2	0.350	0.250
1.5	0.250	0.150
1.25	0.250	0.150
1	0.150	0.100
0.75	0.100	0.050
0.5	0.100	0.050

Where a conduit is to be bent in a large radius, involving long lengths of pipe and several fittings, the cost of bending, exclusive of cost of assembling parts, is about two cents per lineal foot of bend as a maximum and an average of 1.2 cents per foot for 1.25-inch conduit or smaller.

It is sometimes desirable to run a conduit between buildings underground. If the conduit is given a good wrapping with tarred canvas this will more than double its life. The cost for wrapping, including material and labor but no pipe or conduit, averages as shown in Table IV.

TABLE IV.—COST OF WRAPPED CONDUIT.

Size of conduit in inches.	Dollars per foot.
0.5 to 1.0	0.015
1.25	0.019
1.5	0.022
2.0	0.027
2.5	0.032
3.0	0.049

Proposed Ordinance for Licensing of Electricians in Youngstown, O.

The proposed ordinance for the licensing of electricians in Youngstown, O., provides for a license fee the first year amounting to $100, and for a fee of $2 a year thereafter. Master electricians will be examined by a board composed of a contractor, a journeyman and the city wiring inspector. The ordinance is said to be modeled after those in force in the larger cities of the state. Considerable objection is expressed by the smaller electricians, principally on the size of the initial fee, and a protest against this has been filed with the council on their behalf.

After conducting a municipal electric store for some time, the town of Estevan, Sask., has decided to discontinue this practice. Local dealers are taking over the stock of the town and undertake to carry on the business at reasonable figures.

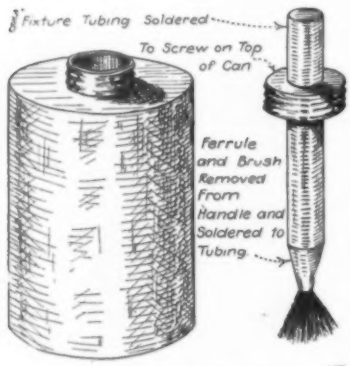
Dollar Wiring Kinks.

Every reader is invited to contribute to this column. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; and if a diagram is necessary, a rough pencil drawing will serve. The idea itself must, of course, be new and bright. A dollar will be sent to the contributor upon publication.

Paint Can.

A handy paint can, which can be carried in the tool bag without having the paint spill or dry up, is made as shown in the accompanying illustration, from a small screw-top can.

A hole is punched in the cover which will admit a piece of three-eighth-inch brass fixture tube. This is soldered to the cover with enough projecting to make a handle. Remove the handle from a small round paint brush and solder the ferrule to the inside end of



Handy Paint Can.

the three-eighth-inch tube. When the cover is screwed in place on the can, the brush is on the inside out of the way. With such a can the paint does not dry up nor spill and the brush never becomes hard. I find that a can about 3 inches long and about two inches in diameter is the handiest size.

J. H. Hilfiker.

Pocket in a Parquet Floor.

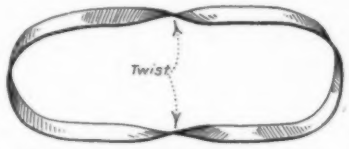
Many electricians find it very difficult to take pockets up in parquet flooring but below is a very good method.

Parquet flooring is fastened down with nails that are covered with wax. By examining the floor carefully you can very easily tell where the nails are. Scrape the wax off the nails and countersink them until they are through the parquet floor. Do this to as many pieces of flooring as is necessary. Put a screw in one of the holes left by the nails. Take hold of the screw with a pair of pliers and lift piece of flooring up. Under the parquet floor is the rough floor; this can be cut away very easily, after the parquet flooring is removed. To put parquet flooring back in place again, a little larger nail should be used. This method will never spoil the parquet flooring.

William P. Smith.

Flashing Sign Motors.

I am working for a circuit of theaters which operate flashing signs. Every once in a while when on my way home I notice a sign that is not working properly and find it is generally the fault of a belt slipping on the pulley. For an emergency repair



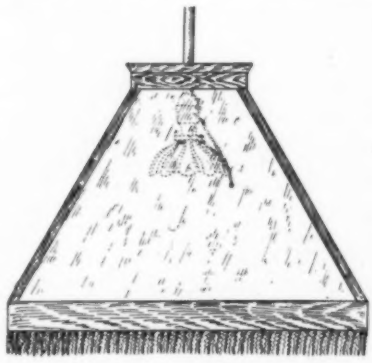
Tightening Belt for Flasher Motor.

I take the belt and twist it, as shown in the accompanying illustration, and let it run with the twist in it. This takes up just enough slack to tighten the belt and the belt runs satisfactorily until there is an opportunity to make a permanent repair.

Frank Hansen.

Reflector in Dome.

It is well known that the colored glass used in domes has little reflecting power. Where a single light is used in a dome in connection with a chain socket, the light can be vastly



Reflector in Dome.

improved by placing on the socket a 7 or 8-inch scalloped opal reflector, using a 40 or 60-watt tungsten lamp.

B. H. Hankins.

Plugging Conduit.

Having a number of conduits to lay under a floor, with ends bent up and sticking out about six inches above the floor level, there were no pipe caps or plugs on the job to seal the ends of the conduits while the cement floor was being laid; so I first screwed on a coupling, then made wooden plugs about the length of the coupling, of a diameter to fit the inside of the conduit. They were then driven flush with the top of the coupling. To remove the plug it was only necessary to remove the coupling, and the pliers will easily remove same. This is a better way than merely putting in a wooden plug, as it cannot be broken flush or knocked off by other men on the job.

J. M. Lamoureux.

Box for Soldering Paste.

Take two old keyless socket shells, the 20 point adjustment kind, cut one of them off at the bottom end of the large part, and solder it on over the smaller part of the other shell, upside down. Solder a piece of sheet brass over the small end of the shell to make a bottom. Make a ring out of No. 8 or No. 6 bare copper wire to fit the middle finger, and solder it into the cap to make a lid. This lid can be

Socket Shell for Soldering Paste.

changed to either end of the box. This is a handy arrangement to use for soldering on house-wiring jobs, as it leaves both hands free to work with, and you have the soldering paste handy to reach and the box is always open.

It should be worn on the back of the hand, as shown in the illustration, when soldering. When through soldering, change ends with the cap and you have a tight box to carry your soldering paste in.

H. M. Hamilton.

Extension Bit.

In wiring old houses it is frequently useful to have an extension bit. One which is suitable for carrying in the kit can be made by taking an old brace and bending it out straight. The handle is cut off and the end filed square to make a shank which will fit the chuck of the brace.

George E. Taylor.

Public Service Commissions

Conducted by William J. Norton

CALIFORNIA.

The Oro Electric Corporation was authorized to pledge $180,000 face value of its bonds as collateral security for an issue of $60,000 of notes. These notes are to be dated March 25, 1915, and are to mature serially within a period of one year after date.

The Mount Whitney Power and Electric Company was authorized to issue $238,000 of its six-per-cent bonds at not less than 95.

INDIANA.

The Evansville Public Service Company has carried its injunction suit against the Indiana Commission to the federal courts. The company is asking that the Public Service Commission be enjoined from enforcing its order for the lowering of gas rates in the city of Evansville to 85 cents a thousand cubic feet. The suit by the company alleges an erroneous and unlawful appraisal of its property on which the new rates were based. The value of the property of the company, as appraised by the Commission, was approximately $750,000. The company asserts its property is valued at $1,400,000.

The company also contends that under a ruling of the Superior Court of Vanderburg County, which refused an injunction against the Commission, on the grounds that the public utility act does not provide for temporary injunctions, is in effect a confiscation of its property without due process of law, contrary to the constitution of the United States. The complaint also charges hat the penalties provided in the utility act for violation of the statute are unreasonable and unnecessary.

KANSAS.

The Topeka Edison Company. A petition has been circulated in Topeka asking that the question of providing for a municipal plant be submitted to the voters. The city, however, has taken action to secure a lower rate from the company, instead of undertaking municipal ownership. It has been agreed upon by the city officials that the rate be fixed at 7 cents, and that this rate be drafted into the ordinance. The company has offered a flat rate of 7.5 cents a kilowatt-hour, provided the minimum charge for service is raised from 40 cents to 75 cents.

MARYLAND.

The Consolidated Gas, Electric Light and Power Company, of Baltimore, filed a new industrial gas rate with the Commission March 1, 1915, effective April 1. The new rate is in the form of a demand rate, which corresponds exactly to the demand rate for electric utilities. The fixed costs in the gas rate correspond to the demand charge in electric rates and the running costs correspond to the energy charge. Gas for industrial uses in specified location will be sold under this schedule to any customer who has signed an agreement for permanent gas service for a term of at least three years, embodying the terms and conditions of the Company.

The fixed price is to cover the Company's fixed investment and operating charges in establishing service and standing ready to serve, and does not include the supply of gas. The following are the new rates: Per year, $204, payable in monthly installments for the first 300 cubic feet per hour of demand or fraction thereof; $48 per year per 100 cubic feet per hour of demand in excess of 300 cubic feet per hour.

The running charges are as follows: Gross, 70 cents, or 60 cents net per 1,000 cubic feet for gas supplied up to 20,000 cubic feet per month; 45 cents gross or 35 cents net per 1,000 cubic feet for excess gas up to 1,000,000 cubic feet per month; 40 cents gross or 30 cents net per 1,000 cubic feet for all gas supplied exceeding 1,000,000 cubic feet per month.

The demand is the maximum rate of use, and is defined as the greatest number of cubic feet used in any one hour, and shall be specified in the contract. The specified demand shall be subject to revision by actual measurement of the customer's maximum hour's use by suitable instruments furnished by the company. The demand having been thus established, shall not be substantially decreased during the term of the contract, but shall be increased in accordance with and for all billing after any increase in maximum use, which may, from time to time occur. Upon extraordinary occasions for a certain limited period, the company may, at its option, give permission to exceed the determined maximum rate of use by a stated amount without increasing the nominal demand upon which charges are based.

A provision is made for non-peak service, as follows: For installations in which the use of gas is considerably less between the hours of 5:00 p. m. and 7:00 p. m., during the period from October 1 to the succeeding March 1 than at other times, the demand upon which the rate is based may be taken as the measured rate of use occuring during any hour between the said hours in the said winter months; provided that the demand shall in no event be taken as less than one-half of the maximum measured rate of use at any other time.

NEW JERSEY.

Regulation of Municipal Utilities. A measure placing municipally-owned utilities under the regulation of the Board of Public Utility Commssioners has been passed by the Senate.

NEW YORK.

The New York Edison Company has notified the First District Commission that it will accept the order adopted by the Commission March 16, directing the company to reduce the maximum rate for electric current after May 1, 1915, from ten cents to eight cents per kilowatt-hour, exclusive of the installation and renewal of lamps. The company announces that a new schedule of rates, in accordance with the order, will be filed with the Commission at an early date. The new rates are to remain in effect for a period of three years.

Nothing in the order affects the United Electric Light and Power Company, which is a separate concern, although, like the New York Edison Company, it is owned by the Consolidated Gas Company. It was stated by the officials of the Consolidated Gas Company, however, that whatever action is taken by the New York Edison Company is likely to be followed by the United Company. In certain districts of the city there is sufficient competition between the two concerns to make it impossible for one to keep its rates up while the other has reduced its charges.

Commissioner Maltbie has expressed the opinion that if it became necessary to institute against the United Electric Company new proceedings to make it cut its rates, there was already on file before the Commission a good deal of evidence which could be applied to the new case.

OHIO.

Federal Gas and Fuel Company. Judge Kinkead of the County Courts has handed down a decision as to the meaning of the clause in the company's franchise granting the city part of the revenues of the company. The section of the contract relating to the royalty reads: "For the benefit of the general expense fund of the city, 10 per cent of all moneys received from the sale of natural gas sold at a price exceeding 15 cents per 1,000 cubic feet."

The court holds that cities are permitted to collect an amount sufficient to provide for a proper inspection and care of the streets affected by gas-company activities. The sum paid by the Federal company under the contract is found to be greatly in excess of the amount necessary to "regulate" the gas company, and is, in fact, a revenue measure. However, the court abides by the Supreme Court decision, in which similar contracts with the Citizens' Telephone Company and the Columbus Gas Company were upheld. The decision says:

"By the construction of the contract adopted, and under the decisions of the Supreme Court before cited, the contract may be sustained. The view of this court is that a municipality representing its inhabitants and holding the streets for their benefit, consenting to their use by public service corporations for public necessities of life, being obligated to fix the rates of such utilities, requiring such companies to pay all the cost of regulation and to guarantee against all contingent expense, the general revenue being raised to pay general expense, is not justified in adding further to the burdens of the people by assessment against such utility as to material increase the burden of all classes upon such necessities as light and fuel."

OKLAHOMA.

The Oklahoma Gas and Electric Company has been ordered to reduce its rates for power service. The complaint filed with the Commission alleged that the company's minimum rate for power was excessive. The rate heretofore charged by the service company has been $1.00 per month per horsepower up to fifteen horsepower, 75 cents for the next fifteen and 50 cents for all above thirty horsepower.

Many of the plaintiffs, when they installed power motors, did so with an expectation of rapidly increasing business, and, therefore, installed motors larger than was needed. When this expected increase failed to materialize the power consumers had to pay a minimum based on the large motors, although they were not used to full capacity. For this reason they asked that the minimum be abolished. The opinion says, however, that this is not a fair procedure, and decisions of other Commissions are cited to show that a reasonable minimum charge is necessary in order to be fair to the public service company.

It was contended by the defendant that the company must be ready to accommodate the full horsepower on their lines, and for this reason they should be allowed to collect the minimum rate in effect. In regard to this contention the decision compares the company's business to that of a bank, saying that business is based on previous experience, and that while a bank must keep enough cash on hand to meet the expected demands, it rarely, if ever, keeps enough to pay off its total deposits.

To the plea that the defendant was acting only on the charter granted it by the city, which provided for the minimum $1 per horsepower on power meters, the order replies that the Commission has the power to alter such rates made by charter. The fact that the conditions at the time the charter was granted were totally different than now, was also advanced by the Commission in its order. The final order provides that the future minimum rate shall be $1 for motors of one horsepower or less, 50 cents for the next twenty-nine horsepower, and 25 cents for each additional horsepower over thirty. According to agreement, the service company is to refund all amounts above these charges collected since May 1, 1914, the time when the complaint was filed.

PENNSYLVANIA.

The East Berlin Railroad Company refused to continue operation, for the reason that the service has been conducted at a financial loss for a number of years. Upon complaint, brought by residents dependent upon this service, the Commission says: "When the commonwealth originally granted to the incorporators the right to construct and operate a railroad, those incorporators acquired certain rights which the commonwealth does not grant to individuals, and with those rights the incorporators necessarily assumed certain duties and responsibilities to the state and to the public. These rights are predicated upon a contract between the incorporators and their successors, and the state that so long as the franchise exists, the company will continue to furnish to the public the service contemplated in its charter. The granting of such a charter and the exercising of the rights thereby given did not give to the company a mere license, which it can surrender without the consent of the state. When a railroad charter is granted, the company secures the right to construct the line mentioned in the charter. When it has exercised that right it enters into a contract with the state to operate the line until such time as the state has authorized it to discontinue the operation. It is true that the state may look upon a non-user as a forfeiture of the rights granted, and proceed to declare the franchise null and void, but until such action is taken by the state the company is bound to perform the service which it undertook when it constructed its line under the powers given it by its charter. The Legislature has provided a method by which the company can at any time apply to the state for the right to surrender its charter and franchises and cease to do business. But until either the state has forfeited the charter or the company has surrendered the same, the contract between the state and the company must be carried out according to its terms.

"As was stated in the case of Wright against the Railway Company, 95 Wis. 37: 'A public duty is not to be laid down at will. In case of a mere easement, there is but one party interested, and he may voluntarily abandon his right, but in case of a public duty there are two parties beneficially interested—the party who owes the duty and the state to which it is owed. In order to extiguish the duty there must be concurrence on the part of the state.

"The Commission is of the opinion that the respondent, the East Berlin Railroad Company, is bound to furnish reasonably adequate service on its line of railroad from East Berlin to Berlin Junction, until such time as the duty imposed upon it by the state shall have been surrendered and the surrender accepted by the commonwealth."

WISCONSIN.

The Rhinelander Power Company applied for, and was granted, authority to advance its rates for electrical power. A number of years ago the company entered into long-term contracts with the Rhinelander Paper Company and the Rhinelander Lighting Company, disposing of an aggregate of 1,310 horsepower out of its rated capacity, leaving available for sale to other customers about 290 horsepower or 116 kilowatts. The company alleged that the rates fixed in these long-term contracts are inadequate and that unless it is enabled to derive more income, it will be unable to continue to furnish adequate service to the public and its individual customers.

The decision takes up two main questions. The fact that by far the larger part of the product of the petitioner goes to a private concern, raises the question as to whether or not the company is a public utility subject to regulation. A number of decisions of courts and commissions, bearing upon this and similar questions, were cited and the Commission concludes that the power company was a public utility within the meaning of the law when the contracts in question were entered into, and is now a public utility subject to Commission regulation.

The question as to the Commission's power to change rates fixed by such contracts is discussed at length. The decision says: "The second question, that of the validity of the contracts made by the petitioner for the disposal of current, is more specifically a question of law for determination by the courts, than is the first question. The petitioner company being a public utility, however, and this Commission being asked by it for permission to establish a new schedule of rates, and a change in rates necessarily involving the question of the validity of the existing contracts, whether it grant or refuse the permission asked for, the Commission should give its reason for considering or refusing to consider the contracts void as against public policy." . . .

Numerous citations from court decisions dealing with the question as to when such contracts are voidable, are given. The Commission concludes as follows: "The power to regulate rates of public service corporations is a power belonging to sovereignty. Under our form of government it inheres in the state and is given expression by the Legislature. In the case of a municipality the Legislature may, and does sometimes, divest itself temporarily of the right to interpose to fix or change rates by giving the municipality the power to act for it in regulating rates. But the Legislature never divests itself of that power by conferring it upon a public service corporation. Any rates named, therefore, by a public service corporation in any contract are always subject to change by the Legislature, if it so choose. This power of the state to regulate rates is implicit in every contract touching rates made by a public utility.

"For the state through the Commission to interpose in the present case or in any such case to change or authorize a change in the rates named in a contract, is not such an impairment of contract obligations as comes within the inhibition of the Constitution, but instead is carrying out one of the terms or provisions of the contract (145 Wis. 13). A case decided by the Supreme Court of Wisconsin as late as December, 1914 (M. St. P. & S. S. M. Ry. Co. appellant v. Menasha Wooden Ware Co.), makes very clear this principle."

The Commission made a valuation of the company's property and an investigation of the cost of the service. The Commission found the value of the physical property to be $80,883. The company operates entirely by water power derived from the Wisconsin River. The maximum value of the water-power rights was placed at $80,000. Allowances for working capital and going value brought the total value to approximately $200,000.

In arriving at the above allowance for water-power rights, the Commission took, as a basis of comparison, the estimated cost of a steam plant of equivalent capacity. The company does not possess an auxiliary or reserve power of any kind and consequently the probability of interruptions in service due to inadequate water supply lessens the value of the present service. The Commission, therefore, deducted from the savings derived from the operation of the hydraulic plant, as compared to the hypothetical steam plant, an amount sufficient to cover the cost of an auxiliary steam power plant.

From the analysis of the power company's business it was shown that the company is not earning and cannot hope to earn at any time under the contract rates a reasonable return. "So wide is the discrepancy between what would be a reasonable return and the amount actually received for its service that the ability of the utility to maintain its service is threatened, if indeed the very existence of the enterprise is not in danger."

The Commission therefore held that considerations of public policy require that the power company be permitted to rearrange its schedules in order to secure more nearly a reasonable return. The Commission points out, however, that it may be difficult to market the company's product in the limited field at rates affording the rate of return to which the company is entitled and that this factor must be given some consideration.

The rates fixed by the Commission provide a demand charge of $30.00 per year (payable in monthly installments) for each kilowatt for the first 10 kilowatts of demand, and $20.00 per year for each kilowatt of the next 40 kilowatts of demand, and $10.00 per year for each kilowatt in excess of 50 kilowatts of demand, plus an energy charge of 6 cents per kilowatt-hour for current used up to an amount equivalent to 20 per cent of the continuous use of the maximum demand, and 2 cents per wilowatt-hour for all current in excess of 20 per cent of the continuous use of the maximum demand.

Questions and Answers.

All readers of the Electrical Review and Western Electrician are invited to submit questions and answers to this department. Full names will not be printed except where the writer indicates his willingness therefor. Anonymous communications will not be considered. Questions relating to electrical matters of any kind will be inserted. Answers from our readers should be received in this office preferably within ten days of the date of publication of the question, and will be published in a subsequent issue. Payment will be made for all answers published.

Questions.

No. 272.—Electric Shock.—In the case of electric shock, which is more dangerous, (a) direct current or alternating current, (b) high frequency or low frequency, (c) high voltage with small current or low voltage with large current?—T. J. S., Butte, Mont.

No. 273.—Talking Sign.—What length of exposure is regarded as best for the successive flashes of an electric talking sign in which the words are flashed on one at a time?—B. F., Chicago, Ill.

No. 274.—Truing Commutators.—In turning up a commutator it is difficult to secure a smooth surface because the mica segments are harder than the copper and therefore are likely to remain as small ridges that will increase with wear of the copper. I was told recently that by soaking the commutator with oil the mica would become softened so as to give under the tool as readily as the copper, and therefore make a perfectly true commutator. Is this method effective? If so, how is the oil applied, by merely surrounding the commutator with oily waste or by immersing the entire commutator in oil? How long should the oil be applied?—P. H. E., Ashtabula, O.

Answers.

No. 263.—Rewinding Motor.—I have a series motor running at 1,100 revolutions per minute that I want to have run at 1,700 revolutions. I would like to know whether to rewind the armature alone or to rewind both the armature and fields. At first I intended to rewind only the armature and connect the fields in multiple, which it seemed to me would answer the same purpose as rewinding the fields; then I thought I would find out what other readers suggest.—J. B., New York, N. Y.

As this motor has a wide variation of speed with the load, I presume that the speed of 1,100 revolutions per minute is the load speed with the motor fully loaded. Since the change is not very great it is barely possible to change the lead of the brushes somewhat, but if this cannot be accomplished easily, it might be advisable to change the lead of the commutator. In either case this would be very much easier than rewinding either

armature or fields, and as I have done it before, it no doubt would work out satisfactorily. If the fields are connected in multiple the motor might draw excessive current and it is possible that it would run altogether too fast.—G. W. C., Roslindale, Mass.

To answer this question properly it ought to have been stated what is the capacity of the motor and whether the output of the motor will be increased in proportion with the new speed or whether the horsepower of the motor will be maintained. In the former case the current taken from the line will be higher than at present, in the latter not.

If the power increases in proportion with the speed, armature and field must be rewound. From the speed of the machine it can be safely assumed that the armature winding has several turns per commutator bar. This number of turns per bar has to be reduced in the ratio 1,100/1,700, using the same commutator. The section of the wire must be increased in the ratio 5,100/1,100, or as near as possible to this.

The magnetic field (ampere-turns) ought to be the same as before, that means the number of turns per field coil must be reduced in the ratio of old to new current. It might be that connecting the field coils in two groups in parallel (with half the new current in each group) gives, with the rewound armature, approximately the right speed. Differences can be adjusted by a shunt across the two groups of parallel coils, if the speed is too low, or across the armature, if too high. If the poles are bolted on (not cast into the yoke) the speed can also be adjusted to a certain degree by altering the air gap, i. e., putting in liners (if possible for mechanical reasons) if speed is too high, taking out liners (if now in use) for too low a speed.

If, on the other hand, the output and therefore the current remains the same for the new speed, the armature only is to be rewound, but without increasing the section of the wire. The number of turns per bar is reduced as mentioned before. This is preferable to weakening the field as the commutation is better with full field than with weak field, especially when the motor has no commutating poles. The speed can be adjusted to the right value as described before. The efficiency will be slightly worse if adjustment is made by a shunt across the armature; otherwise it will not be influenced materially.—H. A., Pittsburgh, Pa.

No. 267.—Voltage Regulator.—Does any one know of a device which can be used on a 550-volt, three-phase circuit to regulate the voltage of same independent of the generator? It is a case where three generators are used at different times to supply a line and the ordinary regulator as applied to each machine would be too expensive.—A. S. N., Plymouth, Mass.

In this case I would suggest an induction regulator.—F. G. S., Ampere, N. J.

Would use a feeder regulator on this particular line. Probably the best type suited for this installation would be a polyphase induction regulator. Although an induction type regulator has greater magnetizing current, is more noisy in operation and less rapid in action, it has the advantage of an unbroken voltage range and no contacts to arc and burn, as has the step-by-step regulator. Data on this type of regulator can be had from any manufacturer. See also various handbooks for electrical engineers.—H. E. W., Chicago, Ill.

The most obvious way to accomplish the desired result is to install a Tirrill regulator for the control of the exciter fields. The Tirrill could be connected to control the fields of any or all the generators, as desired; it could also be connected to maintain constant pressure at the station busbar, or at the end of any one feeder. It would not be expensive to install, and would indeed be by far the cheaper way. The only difficulty that might arise would be on account of the exciters; machines operating off Tirrill regulators should preferably have fairly low flux densities in order that the time element necessary in changing the voltage may not be so long as to affect the regulation.

It is possible to regulate the voltage of a circuit independently of the generators by means of regulators connected in the individual feeders. Either one three-phase or three single-phase regulators may be used for this purpose. For a balanced load, or even one approximately so, one three-phase regulator is preferable, since it is cheaper than three single regulators and occupies less floor space. On the other hand, it is not possible to regulate the phases independently of one another, but this is no real disadvantage if the loads in the individual phases are fairly well balanced.

The regulator may be placed at either the generator end or the load end of the feeder, as most convenient, and should operate automatically. If the regulator be installed at the generator end of the line, a contact-making voltmeter will be required, having the compensation coil set to compensate for line drop at whatever power-factor is desired. Two interconnected current transformers, or one possibly, will be required for the contact-making voltmeter. If the regulator be installed at the load end of the line, a simple voltage-regulating relay will suffice, set to maintain the voltage desired. In this case no current transformer is required. At whichever end of the line the regulator is installed, there will be needed one or three auxiliary relays for controlling the motor or motors, depending upon whether one three-phase or three single-phase regulators are used.

Since such a low pressure as 550 volts is used, it is probable that the power transmitted is not great, but even so the cost per kilowatt of installing the regulators will be high, even excessive for the majority of cases. The cost of equipment, the cost of installing, and the cost of maintenance, will all be in excess of a Tirrill. The advantage of feeder regulation is that each feeder can be regulated independently of any other feeder, and each individual case must decide what expenditure is justified to accomplish this.—I. L. K. R., Chicago, Ill.

No. 268.—Electric Thawing.—The water pipes to a motor-driven pump became frozen and electric thawing was tried, but with no favorable result. The pipes were three inches in diameter and about 60 feet long; they were partly underground and partly submerged in water. How should the thawing apparatus be arranged and how much power should be applied and for how long a time?—H. S., Verdum, Que., Canada.

The writer has had considerable experience in thawing pipes, both with direct and alternating current. I have found that about 10 kilowatts for large pipes to be the best, using current at about 20 to 30 volts. In using direct current a rheostat should be used to lower the voltage and regulate the current. I have found that pipes will thaw quicker at a moderately low voltage and high amperage. In using the alternating current I use a transformer and tap the primaries wherever wanted, connecting the secondaries to 50 volts or lower, if possible, and using a rheostat. We at one time thawed an eight-inch pipe frozen 30 feet in two hours and a half, using current as described.—A. H. L., Manson, Iowa.

The length of time required to thaw a frozen pipe varies inversely as the square of the current used, that is, by doubling the current you produce four times the heating effect; therefore, using 200 amperes will thaw a pipe in one-fourth the time that 100 amperes will require. The time required also depends on the length of pipe involved, its size and material, the temperature to which it is frozen below the freezing point (32 degrees Fahrenheit), and its surroundings. The latter has an important bearing on the particular case. If the pipe is buried in cinders, sand or other poor heat conductor, it evidently will not lose the heat applied rapidly and quick thawing should result. If submerged in a solidly frozen pond or surrounded by other metal pipes or structures, much of the heat applied by the passage of the electric current will be absorbed or conducted away by the surrounding medium. Consequently in such a case the application of a small current for a very long time may be entirely ineffective because the heat is dissipated as fast as produced. By using a heavy current therefore, not only will the thawing be accelerated but it will be accomplished with

comparatively little total expenditure of energy, since practically all the energy applied will be used in thawing the frozen pipe and little wasted in the surroundings. For this reason, in the example cited above 200 amperes will probably thaw the pipe in even less than one-fourth the time that 100 amperes would take.

On the other hand, the maximum current to be used depends practically on the current capacity available in line and transformers and also on the safe carrying capacity of the joints in the pipe. Should excessive current be used for a long time, lead-calked joints might be rendered leaky. This danger is not very great, however, because it would be found in small pipes only and such pipes seldom use this type of joint.

To get the best results use a transformer with several low-voltage secondary taps, use heavy connecting cables and as short as possible from transformer to the ends of the frozen pipe section, make good electrical connections to the pipe, and use as heavy a current as is available. Such an arrangement obviates losses in rheostats, choke coils, resistance of leads and connections, and applies a heavy current (starting at 20 to 30 volts preferably) direct to the frozen section. —B. H. F., Milwaukee, Wis.

Time is a great factor in electric thawing. The shorter the time the less energy required. This means that to thaw successfully a line of pipe, the power must be large for a short period of time. The writer has made a large number of "thaws" this winter and has considerable data now being worked up, but cannot at this time give exact rules for thawing on account of unknown variables, which need further analysis to bring out. Our first thaw was tried on a water service, using 55 volts and 130 amperes. As the men were at first timid about applying the current, we had the connection up for three hours with no results, then we increased to 110 volts and 180 amperes and the pipe was thawed in 12 minutes. On the average, results were obtained with 100 volts, 300 to 400 amperes and one to ten minutes' time. On three-inch wrought-iron pipe 50 to 60 feet long the kilowatt-hours per cubic foot of pipe was 30 to 40 for two to three hours' time and 1 to 5 for four to ten minutes' time. The potential seems to be around one to three volts per foot of pipe, although, of course, the voltage should not be as important a factor as current. I would suggest that you use as high a current density as is available in order that the time may be as short as possible; cutting the time from two to three hours to as many minutes decreased the kilowatt-hours input in the case cited above from 30 to 40 to 0.5 kilowatt-hour.—H. E. W., Chicago, Ill.

No. 270.—Power-Factor on Distorted Wave.—When a wave of alternating current is distorted (as by variable resistance) to a different shape from the electromotive force, the power-factor is reduced below unity. How can one tell in such a case whether the current is a leading or lagging one?—P. N. C., River Forest, Ill.

In case of a sine current, when it is lagging, the average power is increased by advancing the current in phase and is decreased by retarding the curent in phase. Current is advanced or retarded by making it pass through its recurring values earlier or later. By this same criterion it is possible to tell whether a non-sine current is lagging or leading. Such a current is lagging when the average power is increased to a maximum value by advancing the current in phase; it is leading when the power is increased to its maximum value by retarding the current in phase. Power-factor is increased in the same way as average power. In the case of non-sine waves, the maximum value of power-factor is less than unity.

Inasmuch as the total average power is the sum of the average powers of the various harmonics, as the current is shifted in phase, the power for some of the harmonics may be increased and for others decreased. It is to be noted that this is true only for non-sine voltage *and* current. With a true sine of voltage, the average power for any of the harmonic currents is zero.

Shifting the current forward or back to the position of maximum power may involve a slight decrease in the average power during part of the shift. Conclusion must be reached therefore by the general trend of the effect and not by the effect of a slight change only.

We can conceive of a case with two equal maxima, one approached by retarding, and the other by advancing the current. In such a grotesque case as this, it is doubtful if any significance can be attached to "lag" or "lead."

To apply this theory to an actual case involves considerable trouble and time. One way of checking up a lead or lag on an alternator would be to note the field current taken for the excitation. By comparing this point with the saturation curves of the alternator, a decision may be reached. If we know that a certain field current is required to maintain a given voltage with unity power-factor load (assuming sine current and voltage), a lower field current would indicate a leading current and a greater field strength would indicate a lagging current. The effective power-factor could also be approximated in this way. In the usual case, the departure from sine current is so slight (particularly in the case of varying resistance of an incandescent-lamp load) that this method would not serve.

Another method employs a synchronous motor-generator set. The motor is run from the same supply as the load whose power-factor is to be determined. The alternating-current generator (of the same number of poles as the motor) is connected to the potential coil of a wattmeter. The current of the load is passed through the current coil of the wattmeter. By shifting the stator of the generator, the phase position of its voltage may be varied at will; by comparing the position of the generator with that of the motor, the angle between the line voltage and the generator voltage may be found at any instant. The motor should be excited to such a value that the induced voltage is in phase with the applied voltage (approximately unity power-factor). If this is not done there will be a phase angle between the generator and line voltages, even though the stators are in the same relative positions.

It is self-evident that what was said in regard to shifting of currents applies equally well to the shifting of voltages, provided the proper significance is given to "lag" and "lead."—F. G. S., Ampere, N. J.

No. 271.—Three-Phase Distribution. —Under what conditions is it preferable for a central station to distribute three-phase, four-wire, and when should three-phase, three-wire be used, 2,300 volts being assumed in either case?—P. E., Wheaton, Ill.

Assuming 2,300 volts to be the voltage, it is preferable in overhead-line work for a central station to distribute three-phase four-wire, as this system for a given amount of power allows a considerable saving in copper as compared to the three-phase three-wire system. Another advantage to be gained, if desired, is in grounding the neutral of the four-wire system and thus reducing the maximum potential strain, in case of a ground, to the voltage between any leg and the neutral.—S. C. W., St. Charles, Mo.

The four-wire three-phase system of distribution is usually preferable to the three-wire system for general distribution in large cities and suburbs, where three-phase and single-phase loads are served by the same circuit, and the single-phase loads are of a capacity comparable with those of the three-phase loads. The four-wire system enables power to be transmitted at a pressure of 4,000 volts and distributed at a pressure of 2,300 volts. The three-phase loads are supplied through star-connected transformers fed from between phases (sometimes two transformers are used for small loads), while the transformers for the single-phase loads are connected in between phases and neutral. This arrangement enables standard 2,300-volt transformers to be used, reduces the tendency of unequal loads in the different phases to cause phase unbalance, and permits a greater amount of power to be transmitted for the same line loss for the same investment in copper.—I. L. K. R., Chicago, Ill.

Electrical Engineering Problems.

By R. G. Hudson and W. V. Lyon.

DIRECT CURRENTS.

Problem 29.

A 25-horsepower, 230-volt shunt motor takes a current of 8.3 amperes from the line at no load and runs at a speed of 1,200 revolutions per minute when the field current is 2.5 amperes. The air-gap flux for any magnitude of field current is given in Fig. 25; curve A being for an armature current of 5.8 amperes and curve B being for an armature current of 90 amperes. The resistance (hot) of the armature between brushes is 0.12 ohm and the maximum current which the armature will carry continuously without overheating is 90 amperes.

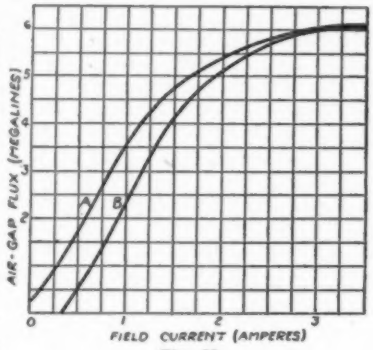


Fig. 25.

The terminal voltage being maintained constant at 230 volts throughout, find the maximum current-flux torque and the maximum gross-power output of the motor under the following conditions; (*a*) field current, 2.5 amperes; (*b*) field current, 1.05 amperes; and (*c*) field current, 3.0 amperes.

SOLUTION OF PROBLEM 29.

It was shown in Problem 24 that the current-flux torque of a dynamo is given by [42]

$$T=8.85BlIZR/10^8 \text{ pound-feet.}$$

It was also explained that the average flux-density (B) equals the total flux [product of number of poles (p) and flux per pole (Φ)] divided by the flux-cutting area on the surface of the armature. The flux-cutting area equals $2\pi Rl$, where R is the radius of the armature in inches and l is the flux-cutting length of each armature conductor in inches. Hence $B=p\Phi/2\pi Rl$. The current (I) in equation [42] is the current in each armature path and equals the total armature current (I_a) divided by the number of paths (p'). Hence $I=I_a/p'$. If the radius (R) in equation [42] is measured in inches the torque is given in pound-inches. Substituting these values in [42] we have

$$T=8.85p\Phi lI_aZR/2\pi Rlp'\times10^8 \text{ pound-inches.}$$

Canceling like terms in numerator and denominator, changing the air-gap flux per pole to megalines and dividing by 12 to change torque units to pound-feet reduces the above equation to

$$T=1.17p\Phi I_aZ/p'\times10^8 \text{ pound-feet}$$

and representing the expression $1.17pZ/p'\times10^8$ by a constant (K) we have

[46] $T=KI_a\Phi$ pound-feet

where I_a is the armature current measured in amperes and Φ is the air-gap flux measured in megalines.

Answer to Question a.

The stray power at no load is given by [43]

$$S.P.=230\times8.3-230\times2.5-(5.8)^2\times0.12=1{,}329 \text{ watts.}$$

Since the stray power at no load is the power required to turn the armature over at a speed of 1,200 revolutions per minute, the current-flux torque at no load may be found from [40]

$$1.329=1.42\times1{,}200\times T/10^4 \text{ kilowatts}$$

and T equals 7.8 pound-feet.

The air-gap flux at no load corresponding to a field current of 2.5 amperes (Fig. 25, curve A) is 5.8 megalines and the armature current is 5.8 amperes (the flux and current are equal numerically by coincidence). The constant (K) in [46] may then be evaluated as follows:

$$7.8=K\times5.8\times5.8$$

and K equals 0.2318.

Under the conditions of Question *a* the maximum armature current is 90 amperes and the air-gap flux corresponding to a field current of 2.5 amperes (Fig. 25, curve B) is 5.7 megalines. The current-flux torque is given by [46]

$$T=0.2318\times90\times5.7=118.8 \text{ pound-feet.}$$

Since the speed under the conditions of Question *a* (see answer to Question *a*, Problem 27) is 1,169 revolutions per minute, the maximum gross output is given by [40]

$$P=1.42\times1{,}169\times118.8/10^4=19.73 \text{ kilowatts.}$$

Answer to Question b.

The maximum armature current is 90 amperes and the air-gap flux corresponding to a field current of 1.05 amperes (Fig. 25, curve B) is 2.5 megalines. The current-flux torque is then given by [46].

$$T=0.2318\times90\times2.5=52.2 \text{ pound-feet.}$$

Since the speed under the conditions of Question *b* (see answer to Question *c*, Problem 28) is 2,665 revolutions per minute, the maximum gross-power output is given by [40]

$$P=1.42\times2{,}665\times52.2/10^4=19.73 \text{ kilowatts.}$$

Answer to Question c.

The maximum armature current is again 90 amperes and the air-gap flux corresponding to a field current of 3.0 amperes (Fig. 25, curve B) is 5.98 megalines. The current-flux torque is given by [46]

$$T=0.2318\times90\times5.98=124.9 \text{ pound-feet.}$$

The speed under the conditions of Question *c* (see answer to Question *d*, Problem 28) is 1,113 revolutions per minute. The maximum gross-power output is then given by [40]

$$P=1.42\times1{,}113\times124.9=19.73 \text{ kilowatts.}$$

It will be noted that the maximum gross-power output is the same in each case. This follows from the fact that the armature voltage and armature current are constant throughout. The armature voltage by [3] equals 230—90×0.12, or 219.2 volts. The power input minus the heating losses in the field and armature winding then equals 219.2×90, or 19.73 kilowatts. This must equal the power output inclusive of the stray power and is therefore the gross-power output.

An examination of the above results reveals the following facts regarding the maximum current-flux torque and maximum gross-power output of a shunt motor operated with variable field current:

(1) The current-flux torque for any armature current is proportional to the air-gap flux. An increase of speed produced by reducing the air-gap flux is accompanied by a reduction of the current-flux torque.

(2) The maximum continuous current-flux torque (from [46]) is proportional to the maximum air-gap flux and the maximum current which the armature will carry continuously without overheating.

(3) The maximum gross-power output for any armature current is constant and independent of the speed.

(4) The maximum net-power output (from the shaft) equals the maximum gross-power output minus the stray power and therefore varies slightly with the speed, since the stray power varies with the speed.

When a shunt motor must be operated

ALTERNATING CURRENTS.

Problem 79.

A three-phase, 25-cycle, 2,200-volt, 12-pole induction motor has a rated full-load capacity of 1,000 horsepower. The ratio of transformation is 2,200:1,480 volts between terminals. The true equivalent single-phase resistances of the stator and rotor windings are 0.065 and 0.0386 ohm at 25 degrees centigrade. The ratios of effective to true resistances are 1.35 and 1.65 for the stator and rotor at 25 cycles. The equivalent single-phase leakage reactances of the stator and of the rotor referred to the stator are 0.35 and 0.31 ohm at the same frequency. The rotor winding is connected in star.

(*a*) What voltage should be impressed on this motor so that the starting current in the line will be 300 amperes? What would be the power, the power-factor and the torque at the moment of starting? (*b*) What reactance should be inserted in each phase of the rotor so that with full impressed voltage the starting current in the line will be 300 amperes? What would be the power, the power-factor and the torque at the moment of starting? (*c*) What resistance should be inserted in each phase of the rotor so that the starting current in the line will be 300 amperes? What would be the power, the power-factor, and the torque at the moment of starting? (*d*) If the impressed voltage is limited to its full-load value, what is the largest torque that can be obtained at starting? How would it be obtained and what would be the current, power and power-factor at the moment of starting?

at constant torque and with variable speed, the adjustment of the speed by varying the resistance of the field circuit is unsatisfactory and may be impossible when the required range of speed is very great. The speed may be adjusted in such a case by connecting resistance in series with the armature as explained in Problem 27, or better by varying the voltage impressed upon the armature, the voltage impressed upon the shunt field being maintained constant. The latter method is used in the Ward Leonard system of speed control. In this system the field and armature circuits are connected to different generators so that each may be varied independently of the other.

SOLUTION OF PROBLEM 79.

Answer to Question a.

As this problem has wholly to do with the motor at the instant of starting, the effective resistance of the rotor winding must be used in the calculations. The effective resistance of the stator winding is

$$r_1=1.35\times0.065$$
$$=0.0878 \text{ ohm.}$$

The true resistance of the rotor winding referred to the stator is

$$0.0386\times(2{,}200/1{,}480)^2=0.0854.$$

The effective resistance of the rotor winding is

$$r_2=1.65\times0.0854$$
$$=0.141.$$

The combined equivalent single-phase resistance is

$$R=0.0878+0.141$$
$$=0.229 \text{ ohm.}$$

The combined equivalent single-phase reactance is

$$X=0.35+0.31$$
$$=0.66 \text{ ohm.}$$

The combined impedance is

by [5a] $$Z=\sqrt{0.229^2+0.66^2}$$
$$=0.70 \text{ ohm.}$$

If the line current is to be 300 amperes, the equivalent single-phase current is $300\sqrt{3}=520$ amperes. The impressed line voltage is

by [3a] $$V=520\times0.70$$
$$=364 \text{ volts.}$$

The power input to the motor is

by [4a] $$P=520^2\times0.229$$
$$=62 \text{ kilowatts.}$$

The power-factor is

by [2a] $$PF=62{,}000/(364\times520)$$
$$=0.317.$$

The torque developed by the rotor of an induction motor expressed in pound-feet is given by

$$T=550pI_2^2r_2(746\times4\pi fs)$$

p is the number of poles for which the motor is wound and f is the frequency of the alternating-current circuit. I_2 is the current in the rotor winding, r_2 is the resistance of the rotor and s is the slip. The slip of an induction motor is the difference between synchronous speed and the actual speed divided by the synchronous speed. Synchronous speed is determined by the number of poles and the frequency. The relation is given in formula [41a]. At standstill, or at the moment of starting, the actual speed is zero and the slip equals 1.0. Therefore at starting the torque developed is proportional to the resistance loss in the rotor winding and any other circuit that is connected in series with it, as in parts (*c*) and (*d*) of this problem. Since the motor is wound for 12 poles and the frequency is 25 cycles, the torque at starting is

$$T=550\times12I_2^2r_2/(746\times4\pi\times25)$$
$$=0.0282I_2^2r_2 \text{ pound-feet.}$$

In this case

$$T=0.0282\times520^2\times0.141$$
$$=1{,}080 \text{ pound-feet.}$$

Answer to Question b.

If the starting current in the line is to be 300 amperes when 2,200 volts is impressed on the motor, the equivalent impedance of the motor winding and the added reactance must be

by [3a] $$Z=2{,}200/\sqrt{3}\times300$$
$$=4.23 \text{ ohms.}$$

Since the equivalent resistance is assumed to be unchanged and is 0.229 ohm, the total equivalent reactance must be

by [5a] $$X=\sqrt{4.23^2-0.229^2}$$
$$=4.22 \text{ ohms.}$$

The equivalent reactance that is added to the rotor must be

$$X=4.22-0.31$$
$$=3.91 \text{ ohm.}$$

This is the value of the added reactance referred to the stator. The actual value would be this multiplied by the inverse ratio of transformation and is

$$3.91\times(1{,}480/2{,}200)^2=1.77 \text{ ohms.}$$

This is the equivalent single-phase value of the reactance. In the case of star connection, the resistance between terminals is twice the resistance of one phase, and so the equivalent single-phase resistance, which is one-half of the resistance between terminals, is equal to the resistance of one phase. The same relation holds for reactance, too. Thus in this case if the reactance is added to each phase of the rotor winding, which is star-connected, its value in ohms is the same as the equivalent single-phase value, and thus is

$$\text{added } X=1.77 \text{ ohms.}$$

Since the resistance is not changed, the power is the same as in (*a*).

By [4a] $$P=520^2\times0.229$$
$$=62 \text{ kilowatts.}$$

The power-factor is

by [2a] $$PF=62{,}000/(2{,}200\times520)$$
$$=0.054$$

Since the current and the resistance of the rotor circuit are unchanged the torque is also unchanged and is

$$T=0.0282\times520^2\times0.141$$
$$=1{,}080 \text{ pound-feet.}$$

Observe that the result of adding reactance to the rotor circuit is not to change the power and torque for a given value of the current but to make the power-factor much less.

Answer to Question c.

If the starting current and impressed voltage are the same as in (*b*), the total equivalent impedance will also be the same.

$$Z=4.23 \text{ ohms.}$$

In this case the reactance is unchanged,

so that the total resistance must be

by [5a] $R=\sqrt{4.23^2-0.66^2}$

$=4.18$ ohms.

The combined resistance of the windings is 0.229 ohm, so that there must be added an equivalent resistance equal to

added $r=4.18-0.229$

$=3.95$ ohms.

If this amount of resistance were added on the stator side the current would have the proper value, but since the resistance of the rotor would be unchanged, the torque would be the same as in both (*a*) and (*b*). The resistance equivalent to this on the rotor side is

$3.95\times(1,480/2,200)^2=1.79$ ohms.

This value is the equivalent single-phase resistance, but, since the rotor is star-connected, it is also what should be added in series with each phase of the rotor winding. The total power supplied to the motor is now

by [4a] $P=520^2\times4.18$

$=1,130$ kilowatts.

The power-factor is

by [2a] $PF=1,130,000/(2,200\times520)$

$=0.988$

The torque developed by the rotor is

$T=0.0282\times520^2\times(3.95+0.141)$

$=31,200$ pound-feet.

Observe that the power, power-factor and the torque are all increased greatly by the addition of resistance to the rotor. This is the practical method by which an induction motor can be made to give a large starting torque.

Answer to Question d.

The equation for the torque of any induction motor at the moment of starting is

$$T=KI_2^2r_2$$

K is a constant determined by the number of poles and the frequency and in this problem it equals 0.0282. The current in the motor is determined by the impressed voltage and the total equivalent impedance of the motor and any added circuit. That is

$$I_2=V/Z$$

The total equivalent impedance, t, is equal to

$$t=\sqrt{R^2+X^2}$$

when R is the equivalent resistance and X is the equivalent reactance of the motor and any added circuit. So we may write for the torque

$$T=KV^2r_2/(R^2+X^2)$$

From this it is seen that the larger the reactance, X, the smaller will be the torque. The total equivalent resistance, R, is equal to the sum of the equivalent resistances of the stator and the rotor together with any resistance added to the rotor. Let r_1 equal the resistance of the stator and r_2 that of the rotor and the resistance added to it. Then we may write

$$T=KV^2r_2/[(r_1+r_2)^2+X^2]$$

By principles of calculus it is easily shown that the torque will have its very greatest value if

$$r_2=\sqrt{r_1^2+X^2}$$

Therefore there should be added to the rotor a resistance whose equivalent value is such as to make the entire resistance of the rotor winding as given above. In this case it would be

$r_2=\sqrt{0.0878^2+0.66^2}$

$=0.666$ ohm.

This is the value referred to the stator. The actual equivalent single-phase value is

$0.666\times(1,480/2,200)^2=0.302$ ohm.

Because of the star connection this is also the resistance per phase. The actual effective resistance of the rotor per phase is

$0.0386\times1.65=0.0637$ ohm.

Therefore the resistance which should be added to each phase of the rotor in order that the torque shall be a maximum is

DIRECT CURRENTS.

Problem 30.

A 230-volt, 15-horsepower shunt motor runs at no load at a speed of 1,250 revolutions per minute and takes a current of 5 amperes from a 230-volt line. With the armature at rest a current of 50 amperes flowing through the armature produces a potential drop of 10 volts between the brushes. If the field current is maintained constant at 2.4 amperes and the stray power is assumed to be constant at all loads, find (*a*) stray power, (*b*) line current at full load, (*c*) efficiency at full load, (*d*) efficiency at half load, (*e*) speed at full load, and (*f*) the full-load torque.

This problem illustrates a method for determining the efficiency, line current, speed and torque of a shunt motor at any load.

ALTERNATING CURRENTS.

Problem 80.

A three-phase, 25-cycle, 2,200-volt induction motor is rated to deliver 1,000 horsepower at full load. The true resistance between terminals is 0.156 ohm for the stator and 0.0920 ohm for the rotor at the running temperature. Assume that at the running temperature the ratios of effective to true resistance are 1.35 for the stator and 1.65 for the rotor at a frequency of 25 cycles, and that the ratio for the rotor is 1.30 at a frequency of 12.5 cycles. The equivalent single-phase leakage reactance of both stator and rotor combined is 0.64 ohm. The ratio of transformation between terminal voltages is 2,200:1,520 volts. The motor is wound for 12 poles. The rotor winding is connected in star.

(*a*) What is the full-load torque calculated on the assumption that the slip is negligibly small? What is the maximum torque that the motor can give, and what is the slip at this time? (*b*) What line voltage should be impressed on the motor in order that the motor will give one-half of its full-load torque at one-half of synchronous speed? What is the value of the equivalent single-phase rotor current referred to the stator? (*c*) What reactance should be added to each phase of the rotor winding so that the motor will develop one-half of its full-load torque at one-half of synchronous speed when the impressed voltage has its rated value? What is the value of the equivalent single-phase rotor current referred to the stator? (*d*) What resistance should be added to each phase of the rotor winding so that the motor will develop one-half of its full-load torque at one-half of synchronous speed when the impressed voltage has its rated value? What is the value of the equivalent single-phase rotor current referred to the stator?

Compare the currents calculated in (*b*), (*c*) and (*d*) with the full-load value, which is approximately 400 amperes.

This problem illustrates methods for controlling the speed of an induction motor.

Solutions of the above problems and two new problems will be printed in the next issue.

$0.302-0.0637=0.238$ ohm.

The total equivalent resistance referred to the stator is

$$R=0.0878+0.666$$
$$=0.754 \text{ ohm.}$$

The total impedance is

by [5a] $$Z=\sqrt{0.754^2+0.66^2}$$
$$=1.00 \text{ ohm.}$$

The current is

$$I=2{,}200/1.0$$
$$=2{,}200 \text{ amperes.}$$

The power supplied to the motor is

$$P=2{,}200^2\times 0.754$$
$$=3{,}650 \text{ kilowatts.}$$

The power-factor is

$$PF=3{,}650{,}000/(2{,}200\times 2{,}200)$$
$$=0.754$$

The starting torque is

$$T=0.282\times 2{,}200^2\times 0.666$$
$$=90{,}800 \text{ pound-feet.}$$

Compare these values with those given in (*a*), (*b*) and (*c*).

Lynn Section, A. I. E. E.

On March 17, before an unusually large audience, Dr. W. P. Davey, of the General Electric Company, Schenectady, N. Y., gave an interesting lecture on "X-Rays." The story of the development of X-Ray apparatus was followed by a discussion of its practical applications, particularly in the medical line. In botany the progress of fruit formation from bud to berry can be traced in a wonderful way. In entomology, insects, destructive or otherwise, may be followed from the egg to maturity. And in chemistry the use of the X-Ray has a widening sphere.

When discussing the subject of the testing of metals the lecturer showed a great number of radiographs by means of lantern slides, and concluded his address by exhibiting and describing the Coolidge tube, produced by Dr. Coolidge, of the research laboratory at Schenectady.

Electrical Men Sell Newspapers in Louisville.

Robert Montgomery, manager of the commercial department of the Louisville Gas & Electric Company, Harry I. Wood, president of the Harry I. Wood Company, and R. E. Brian, manager of the Louisville branch of the Federal Sign System (Electric), assisted by others, sold papers on a platform at Fourth and Chestnut Streets all afternoon on March 19, having volunteered with a large number of others to sell papers to help swell the fund for caring for the unemployed of the city. The business men of the city were well represented for the occasion and a large amount of money raised.

The telephone lines in Melbourne, Australia, are at last underground. Work to this end has been in progress for five years.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

Meeting in Cleveland, O., March 18 and 19.

The 306th meeting of the American Institute of Electrical Engineers was held in Cleveland, Ohio, March 18 and 19, under the joint auspices of the Industrial Power Committee and the Cleveland Section. A total of 300 delegates attended the meeting, which was characterized by papers and discussions dealing mainly with the commercial and practical aspects of industrial power application.

The opening session was held on Wednesday morning, Howard Dingle, chairman of the local Section, presiding.

H. R. Cooley, director of public safety, represented the Mayor in welcoming the visitors to Cleveland. He pointed out the value of conventions and the discussion of common problems in convention, and referred to various analogies in civic problems. President Paul M. Lincoln of the Institute was then introduced, and presided at the remaining sessions.

The first paper was by C. P. Gilpin, entitled "Application of Electricity to the Ore Handling Industry."

The paper gives a general description of the typical method of handling ore from the mine to the blast furnace, describing in a general way the machinery used in the different steps of the process. The general principles underlying the application of electric motors to these various types of machines are discussed, as well as the class of motors best adapted to the work and the considerations in regard to the power installation. The essential points to be considered are: 1, the determination of the shortest path over which the ore is to travel; 2, the determination of the characteristics of the loads in moving ore through this path; 3, the designing of the electrical equipment to carry these loads with minimum peak and maximum reliability, and 4, installation of a substation that will handle the load satisfactorily and most economically, considering both demand charges and the total kilowatt-hours used. In regard to the question of choice of motors the author holds that preference should be given to the mill type where the room is restricted and where momentary overloads are severe and often repeated. Inclosed crane motors are satisfactory in the smaller sizes for less severe and less frequent service, while open-type motors are excellent for service of the car-dumper type where heating is quite a factor but where overloads are not very severe. Either railway or mine-type motors may be used with transfer cars, but if the latter are installed they should probably have a better margin of safety than the former, as they are very compactly built. Mine motors are, however, very convenient in some cases, because they are designed for slow-speed, high-torque work. With regard to the type of field winding, experience has shown that the series-wound motor is admirable for almost all classes of ore handling machinery. Occasionally it is necessary to use a compound-wound motor where there is danger of a runaway, but the shunt field, especially in the restricted space available in a mill motor, is a distinct point of weakness with regard in insulation.

The discussion was opened by D. B. Rushmore, of Schenectady, who pointed out the similarity of an ore-handling system to an electrical transmission system. In ore handling, as in electrical transmission, the cost of distribution is the greatest. He pointed out the importance of reducing this distribution cost and emphasized the value of electric energy in this connection.

R. H. McLain, of Schenectady, commented briefly on the relative merits of inclosed and open motors. He stated that inclosed motors do work for one hour that an open motor would do continuously. He thought that the root-mean-square method of selecting motors should be discontinued, because of the accuracy with which motor manufacturers can ascertain the temperature rise of a motor for a given duty cycle.

H. D. James, of Pittsburgh, thought that considerable of the trouble encountered in the past with electrically driven ore-handling machinery has been due to carelessness in selecting both mechanical and electrical equipment. He thought that criticism of inter-pole motors for dynamic braking is unjust, but in order to obtain satisfactory operation, specifications given to the motor manufacturers should embody data relative to the service that the motors must perform.

The paper was further discussed by D. M. Petty, South Bethlehem, H. F. Stratton, of Cleveland, R. R. Selleck, of Cleveland, and H. L. Wallu, of Cleveland.

In closing the discussion, Mr. Gilpin pointed out that the synchronous converter substation provided with a flywheel balancer, will generally be found to be cheaper and more economical of power than a motor-generator station, the flywheel equipment in both cases being equal. He thought the motor-generator set may have the advantage in certain cases. He favored direct-current motors for most ore-handling operations, and stated that while alternating-current drive could

be provided by installing the necessary control equipment in many cases, the cost of this equipment would about equal the cost of a substation for direct-current supply.

A paper entitled "Line Disturbance Caused By Special Squirrel-Cage and Wound-Rotor Motors When Starting Elevators and Hoists," was then presented by J. C. Lincoln, of Cleveland. In this paper the author examines the cause of line disturbance in starting hoists in elevator motors, and draws comparisons between the performance of wound-rotor motors and squirrel-case motors of a special design for elevator service. It is pointed out that there is a dire lack of exact knowledge among the builders of hoists and elevators as to the amount of torque actually required to start the load, as compared to what would be required if there were no friction. There is also a lack of data from manufacturers of both gears and elevators as to how much higher the starting torque is than the running torque. The paper presents diagrams showing graphically the current required for each type of motor to produce a given torque, and the method of control required by different types of motors. Mention is made of a special squirrel-cage motor designed by the author for elevator duty, which has a rotor of very high resistance, and therefore the maximum or starting current is only one-third to one-half of what it would be with the ordinary squirrel-cage motor. The torque at starting is about 85 or 90 per cent of the maximum torque the motor could deliver with a rotor having the resistance to give the maximum torque. It is stated that a secondary advantage of the special squirrel-cage motor, from the standpoint of the central station, is its more satisfactory service as compared with the wound-rotor motor, and its controller. Delays and troubles, due to small repairs and adjustments on the controller, slip rings, brush holders and brushes, are eliminated. In the conclusion it is pointed out by the author that in order that the wound-rotor motor may start with less current than the special squirrel-cage motor, under any circumstances, a controller must be provided in which the steps of resistance are cut out in approximately equal time intervals. This is best accomplished by means of a dash-pot, and experience has shown the dash-pot controller to be subject to so many troubles that few of them are used.

H. D. James, of Pittsburgh, R. H. McLain, of Schenectady, and H. L. Wallu, of Cleveland, discussed this paper. Mr. James stated that in regard to one of the conclusions of the paper, namely, that if the standard series relay type of controller is used on the wound-rotor motor, the maximum torque must be exerted on the first step, for sometimes the maximum load has to be lifted, is true only if the torque referred to is the torque at the drum. He thought that for slow-speed freight elevators, a squirrel-cage motor had advantages over the wound-rotor type. He cautioned against sacrificing service in an elevator installation to obtain improved starting conditions from the central-station standpoint.

Mr. McLain also recommended a squirrel-cage motor for slow-speed elevators, and where peaks do not affect the voltage, as in large power systems or isolated plants. He thought the slip-ring motor much more satisfactory where high-speed elevators are used.

Mr. Wallu stated that the central-station company is more interested in the duration of the peak than in its volume.

In closing the discussion, Mr. Lincoln stated that the paper discusses motors from the standpoint of small elevators, only. He agreed that for high-speed work a slip-ring motor was to be preferred.

At the session on Friday morning J. F. Lincoln, of Cleveland, presented a paper entitled "Answer to Some Questions on Electric Arc Welding." This paper contains a general description of the process of electric arc welding, and discusses some of the general principles involved in this work. It is stated that all metals can be welded, and the electric method is superior to any other, because of its ease of application and the economy with which heat can be concentrated at any given point. The difficulties encountered in welding are formation of oxide, expansion and contraction under heat, and burning through. The formation of oxide is particularly troublesome in welding brass and zinc, and it is usually necessary to puddle the welding. This is not necessary in welding steel, to which welding is applied to a greater extent than any other metal. In regard to expansion, it is necessary to apply heat either all over the piece to be welded, or at certain points, so that the uneven conctraction giving rise to internal stresses will be avoided. In the case of cast iron, it is often necessary to anneal after welding. The trouble from burning through can be avoided by backing up the weld with a metal face, or by decreasing the intensity of the arc so that the melting through will not occur. In comparing electric with other methods of welding, it is pointed out that the electric arc will melt metal in a weld for from three to 30 per cent of the cost of melting it with the oxy-acetylene blow torch on account of the fact that the heat can be applied exactly where it is required and in any amount that it is required.

The three most important considerations in the design of the welding machine are the variation of the supply voltage, as required by the arc; power economy, and conversion from alternating current to direct-current energy. The usual welding machines consist of a motor-generator set, the motor of which is adapted to the existing supply circuit, and is direct-connected to a compound-wound generator delivering current at approximately 75 volts. This current is applied to the arc in series with a resistance in order to get the variations in voltage required. By this method, it is stated that from 80 to 90 per cent of the current is dissipated in heat in the resistance. A machine is referred to, designed by the author, which will deliver the required voltage at the arc without the use of a series resistance. With such a machine, the cost of operation, using a metallic electrode, will be 25.2 cents per hour, as compared with 72 cents per hour using motor generator and resistance, and for the carbon electrode 42 cents per hour, as compared with 84 cents per hour using motor generator and resistance.

A. M. Dudley, of Pittsburgh, presented a discussion of this paper, prepared by E. M. Zook, of Pittsburgh. Mr. Zook stated that theoretically all metals can be welded, but this does not work out in practice. He inquired as to the success of welding cast iron. He agreed that one of the serious drawbacks to electric welding heretofore has been the lack of skillful operators, as the strength of weld depends more upon the skill of the operator than any other one item. He referred to welding in railway shops, where it is frequently required to carry on several welding operations from the same source of power, and asked if this was possible with the machine referred to in the paper.

L. P. Crecelius, Cleveland, referred to an installation where arc welding and acetylene welding were both used. The latter was preferred because of the ability to concentrate the flame.

A. S. Bemis, Cleveland, spoke of the relative merits of metallic-arc and carbon-arc welding, and stated that while greater speed can be obtained by using the carbon-arc, the current consumption is greatly in excess of the metallic-arc system.

D. B. Rushmore, of Schenectady, called attention to the service which the oxy-acetylene welding companies are furnishing to their customers. He thought that the success of electric welding depended to a considerable extent upon furnishing service of equal character.

C. S. Powell, of Cleveland, inquired as to the efficiency of electric welding, in cutting metals, as compared with acetylene.

In closing the discussion, Mr. Lincoln stated that cast iron is being successfully welded in many instances. However, if it is to be machined, the casting must be pre-heated or annealed, after being welded. In regard to multiple welding, he thought the individual operation most efficient, and it is possible, because of the saving in electric welding, to install as many units as desired, where it is necessary to perform several operations on a single piece of metal. He agreed that with the carbon arc the speed of welding is twice as great as with metallic electrode, but the former can only be used when welding steel castings, and on heavy work, because of warping and oxidation, due to the intense heat. As to cutting metals by means of the carbon electrode, Mr. Lincoln stated that this method was cheaper and cleaner than oxy-acetylene, and also the latter is limited to cuts of a depth of five or six inches.

A paper was then presented by E. H. Martindale, of Cleveland, entitled "Troubles Encountered in the Operation of Carbon Brushes on Direct-Current Generators and Motors."

This paper deals very briefly with troubles which affect the operation of carbon brushes on motors and generators. It should be of great assistance to the operator in locating various machine troubles and in securing the best service from his brushes. The paper is divided into five sections, based on the location of the cause of trouble: (1) field, (2) armature, (3) commutator, including brush riggings, (4) external electrical, and (5) external mechanical.

In opening the discussion, D. B. Rushmore, of Schenectady, called attention to the importance of standardizing brush sizes. He thought this would not only tend to eliminate troubles by insuring proper size brushes being installed when replacements are needed, but it would also reduce the cost to the consumer.

H. R. Edgecomb, of Pittsburgh, pointed out that the brush is the weakest link in the direct-current machines, and therefore it is of great importance that proper attention be given to the mechanical, as well as electrical, features of design, manufacture and application.

R. H. McLain, of Schenectady, pointed out that the reason for poor commutation can often be traced to the control apparatus, where a machine is frequently started and stopped. He mentioned the case of a 200-ampere motor which was reversed at full speed across the line without sparking, although the current reached 1,100 amperes. The same machine sparked excessively when provided with dynamic-braking equipment.

D. M. Petty, of South Bethlehem, called attention to a frequent cause of sparking, namely, poor lubrication. Lubricant frequently sticks to brushes or brush holders, and causes trouble, particularly where machines stand idle for some length of time. He recommended the use of dry lubricants, and also urged that brush sizes be standardized.

W. C. Kalb, of Cleveland, stated that the wear of brushes is frequently due to burning. Periodic cleaning of commutators and brushes will elinminate this trouble.

J. H. Lapp, of Cleveland, thought that the mica used in commutators often caused more trouble than the brushes. Because of the extreme hardness of the mica, the tool used in turning the commutator frequently jumps over the mica, leaving the surface higher than that of the copper. This, of course, results in poor commutation and sparking.

J. P. Mallett, of Elizabeth, N. J., asked what is proposed in connection with the development of pig tails. He held that the tendency is for the pig tail to become loosened by the frequent removal of the brushes, and he advocated that the design, as well as the application, of the pig tail be standardized, as well as brushes.

In closing the discussion, Mr. Martindale stated that the demand for higher current densities for brushes makes necessary the continual development of this field. He presented a list of brush sizes and pig-tail sizes, which the Industrial Power Committee of the American Institute of Electrical Engineers is submitting to the manufacturers for adoption. In regard to mica trouble, he recommended applying oil to the commutator several hours before turning, and also while turning. This has a tendency to harden the copper and soften the mica. In connection with lubrication troubles, he said that these were usually encountered with cheap brushes. There is also some trouble from this source, due to operating machines at temperatures higher than designed for. Pig tails are patented by the manufacturers and therefore cannot be standardized.

At the afternoon session, Bernard Lester presented a paper entitled "Fractional Horsepower Motor Load."

In this paper the author outlines the broad and increasing use of fractional horsepower motors and the chief causes for the advance in popularity of motor-driven machines. The success in this field of motor application has been largely due to the perfection of a reliable and simple single-phase motor. The development in the design and construction of the single-phase motor is traced from its origination to the present time, and the operating characteristics of the commoner types of single-phase motors are described and illustrated by the use of speed-torque curves. The correct application of small motors is of utmost importance and requires a careful analysis of motor characteristics, the characteristics of the driven machine and of the supply circuit, with the limitations of each. The author deals particularly with the characteristics of the split-phase induction motor, which is used so extensively, and points out the functions of the centrifugal clutches when employed as a component part of this motor. A reference diagram is presented which is of service in applying small motors.

This paper was discussed by G. H. Garcelon, of Pittsburgh, who stated that the majority of small motors are operated on 110-volt single-phase circuits. However, there are many variations from this voltage, so that motors must be designed to operate under conditions which are far from ideal. Generally the voltage limits must be from 90 to 120 to give satisfaction. There are also many variations in the frequency of the circuits on which these motors are used, and these variations must be considered in the design of the motors.

A paper entitled "Factors Involved in Motor Applications," was then presented by David B. Rushmore. This paper is a tabulation of the factors involved in motor application, and was intended, the author stated, simply as an introduction to a discussion on the individual features concerned. Supplementing the presentation of this tabulation, Mr. Rushmore presented numerous stereopticon views, showing various motor applications, and he also outlined the plans of the Industrial Power Committee for the remainder of the year.

The discussion was opened by A. P. Lewis, of Akron, who presented a paper on the use of motor drive in rubber mills, following the topics enumerated in the paper. He described the processes involved in rubber manufacturing and the characteristics of the motors required. He suggested group driving for rubber mills, and recommended the phase-wound motor with flexible couplings for numerous drives.

R. H. McLain, of Schenectady, presented a written discussion from C. W. Larson, of Erie, dealing with friction drive. The towing system at the Panama Canal was referred to as a successful application of this method. The author also described methods of securing a uniform co-efficient of friction. Mr. Larson also submitted a discussion dealing with explosion-proof

motors for use in gaseous coal mines.

W. C. Yates, of Schenectady, discussed the safety features of electric motors, and illustrated by means of stereopticon views the various safeguards and safety features which have been developed.

J. P. Mallett presented a written discussion from C. A. Austin, of New York, dealing with a comparison of line-shaft drive and individual motor drive, from the insurance standpoint. It is stated that the insurance companies are recognizing the improved conditions which result from an installation of individual motor drive from an underwriting point of view, and are reducing premiums accordingly. A case is mentioned of a machine shop employing 25 motor driven machines having an annual pay roll of $50,000. The premium for liability insurance per hundred dollars of pay roll is 10 per cent lower than the premium when the entire plant was driven from a steam engine.

William Baum, of Schenectady, presented, by way of discussion, an illustrated paper dealing with the use of electrical equipment in gaseous mines. He pointed out that the development of protective apparatus, first in Europe, and later in this country, permits of the installation of electrical apparatus with the utmost safety.

Harold Goodwin, Jr., of Philadelphia, presented a written discussion dealing at some length with the relative advantages of alternating and direct-current apparatus.

C. R. Weiss, of Philadelphia, presented data on chain drive, and showed various views of installations of this character.

A. M. Dudley, of Pittsburgh, discussed the subject of industrial motor application from the standpoint of frequency, phase and voltage of the motors to be determined upon. He recommended 60 cycles for general use and 25 cycle energy for slow-speed, heavy work. Three phase systems are most common, and voltages of 110 for lighting and small power, and 220 for heavy work, were advocated.

C. Fair, of Schenectady, presented a written discussion dealing with individual motor drive versus group drive for machine-tool operation. He states there are only a few instances where group drive is to be preferred.

An informal banquet was held on Thursday evening, at which H. J. Davies acted as toastmaster, and addresses were made by David B. Rushmore, of the General Electric Company; C. S. Howe, of the Case School of Applied Science; Paul M. Lincoln, president of the American Institute of Electrical Engineers, and Samuel G. McMeen, president of the Columbus Railway, Light & Power Company.

New England Question Box Convention.

A very unique and successful gathering of electrical men of New England was held at the American House, Boston, Mass., March 11 and 12. The discussion was in the form of questions and answers pertaining to electrical problems encountered in present-day practice and much information of value was brought out. A portion of the discussion on the first day of the convention was published in our last issue. The subjoined is a record of the transactions for the remaining sessions.

An effective and cheap method of protecting the ends of cable in iron-base ornamental lamps is to provide a porcelain bushing one inch in diameter and six inches long, and filled with compound. Another suggestion: numbering, initialing and designating underground cables, poles and cross-arms, with a durable composition tag, thus doing away with stenciling poles and cross-arms.

On the subject of tests of 500-volt, three-phase secondary circuits for grounds, it was reported as one company's practice that tests were made monthly, the trouble men clearing them up. For grounding where no water system exists, one method suggested is to place a coil of wire at the base of the pole and ground to that. The use of silicate of soda to induce moisture, in place of salt, was recommended. A company operating in the country districts grounds all secondary transformers at the pole, using a six-foot, 0.75-inch solid rod driven deep in the ground, this being done at every third or fourth pole also.

To protect the public from electrode dust when trimming magnetite lamps, a bag is used, especially when windy.

It was held by some to be good practice to remove a meter and install a new one when complaint of meter accuracy is made, though some objected on the ground that it would justify the complainant in unreasonable claims. When the new meter is installed, economy in current use is likely to follow, and the customer uses the figures to substantiate the justice of his complaint.

H. A. Sawyer, Amesbury, Mass., held this view. E. D. Blackwell, Brandon, Vt., advocated putting in a standard meter in addition to the one already installed and checking up the two in the customer's presence.

O. W. Halladay, Marlboro, Mass., held that the best location for meters was in the cellar, nearest the point of entrance, when secondaries are grounded on water pipes. Otherwise, the first floor would be preferable, owing to greater convenience for readers.

The subject of advertising matter was fully discussed. Members differed as to whether inclosing circulars with monthly bills is of advantage. The Boston Edison Company does not do this.

The chairman thought that the recipient of a bill is in little humor for considering the purchase of new stuff; separate mailings are preferable.

Inducement to equip stores, etc., with gas-filled incandescent lamps of large capacity is by trial installation of these units for three days, furnished by one member company.

The practice of lighting allowance on wholesale power rates was taken up. In Cambridge 20 per cent of the customer's load is allowed for lighting. In Lowell, on a minimum of $650 a month, large customers use energy required for lighting at the same rate by installing their own transformers on the company's 550-volt lines. This is the voltage at which private factory plants generally operate in that city. Fitchburg allows 15 per cent for lighting. Two meters are installed, and the current in excess of the allowance is billed as excess lighting under a different rate. This rule applies to all customers, large or small.

The Providence company allows 20 per cent of kilowatt-hour consumption to be used for lighting, on wholesale contracts. The Worcester company permits any customer with 50 or more connected horsepower to use an equivalent of 20 per cent of the load for light, the customer installing transformers from 550 volts. In Woonsocket, R. I., light from power services is allowed, two meters being installed, one main meter and one demand meter. The customer may put in a 110-volt transformer. None of the customers uses over 15 per cent for lighting. Combined rates apply to department stores, both services being on a demand basis.

In Cambridge, an average of 50 to 60 kilowatts are used by large customers in 300-kilowatt power installations.

A good suggestion as to procuring business of tenants, which is an improvement over the rental plan, is to make a simple business proposition to the landlord, after having created an interest in electric service on the part of the tenant. The central station suggests an increase in rent of 10 per cent on the cost of the electric installation. This is scarcely felt by the tenant, as it would add only 20 or 30 cents a month. This plan has a tendency to get a better class of subscribers for service, with no loss in rental to the landlord. A form letter is sent to house owners outlining the proposition.

A saw mill was finally persuaded to install electric drive. A few weeks

later the agent called and found the mill owner not only satisfied but enthusiastic over the new mode of operation. He had found a market for the refuse which paid for electric current, and he was also able to dispense with the services of a licensed steam engineer.

A Boston suburban company reported an electrically driven re-saw mill operated by a lumber company, which sells its baled shavings and sawdust at 20 cents a bale, the revenue being sufficient to pay 75 per cent of the power bill for the plant, after cost of labor for baling has been deducted.

The high cost of washing machines for home use was considered a handicap in introducing these appliances. The suggestion was made that in household appliances one motor ought to do the work for several machines, perhaps being removable and capable of attachment to other units.

The subject of heating by electricity was presented to some extent by R. J. Patterson, of the Central Maine Power Company. The claim was made that three-cent electricity is a cheaper fuel for cooking than coal at $6.00 a ton. "Until recently, heating water by electricity has been too expensive for ordinary household use," said Mr. Patterson. "Difficulties have been overcome, and now it is within the means of every householder to heat water electrically. To supply 30 gallons of scalding hot water electrically, drawn all at once or a gallon at a time, costs from $4 to $6 a month, which compares favorably with gas heaters. An instantaneous electric water heater connected to an ordinary hot-water system operating at 90 per cent efficiency will heat 50 gallons to 118 degrees with 7 kilowatt-hours, which, at 3 cents a kilowatt-hour, amounts to 21 cents a day." Figures on cooking gave actual costs in favor of using electricity, other advantages being thrown in for full measure. Experiments on a water-heating unit devised by Mr. Patterson were made by the appliance department of the Boston Edison Company. These showed that the temperature of 145 pounds of water per hour was raised from 46 degrees to 140 degrees Fahrenheit, equivalent to 13,572 thermal units per hour. The input of electricity was 4,400 watts, equivalent to 15,017 units per hour; thus the efficiency of the apparatus was 90.3 per cent. There is an apartment house in Worcester, Mass., in which the only cooking provision is electric ranges.

The maximum demand of an installation is seldom more than twice the average. Energy per person for cooking may safely be reckoned one kilowatt-hour a day. The ordinary range sufficient for a family of six, with a connected load of five kilowatts, consumes about 150 kilowatt-hours a month, said Mr. Gale, of the Simplex Electric Heating Company. At a three-cent rate, electric cooking is as cheap as gas at $1.00 a thousand feet.

Members pointed out that consumption of current by electric cookers is often inordinately high the first month, because the operator does not fully understand the apparatus.

Miscellaneous Suggestions.

On wiring a public hall, a company finds it to advantage to install a time switch which it maintains at a minimum charge of one dollar a kilowatt per month, all current being supplied at the regular rate.

Another company is making a proposition to merchants to install a trial lighting arrangement with the proviso that if it proves inconvenient for the customer to purchase the outfit at the end of the trial period of one to six months, the company will carry the installation on a 15-per-cent basis; i.e., pay 15 per cent annually on the cost for the use of fixtures and wiring, with the option of buying them at any time and receiving a rebate of 9 per cent on the cost. The remaining 6 per cent is ample to cover interest, and thus the plan is self-supporting, at the same time providing revenue through regular supply of current.

A plan for installing power on trial is along similar lines. A manufacturer is offered a complete installation of motors ready to operate, and he is allowed to use this on trial for a year, he paying 15 per cent on the retail price of the motors and the contract price of installing. At the end of the year, if satisfied, he may either buy at retail cost or continue to lease at 15 per cent annually. If he chooses to discontinue electric drive, the company disconnects the motors and reconnects as originally operated, at its own expense. This seldom happens.

In a New England city both the regular patrolmen and those in charge of street lamps are required to report outages on customers' signs. If the outage is a carbon lamp, it is replaced without notifying the owner. If Mazdas, on which there is a charge, the customer is either called by telephone or consulted by the lamp man before replacing.

An informal dinner was held at the American House in the evening, more than 250 being present. Afterward a large delegation attended the Boston Auto Show in a body.

Electric Vehicles.

The second day of the convention was given over to the subject of electric vehicles. President Gibbs of the motor car organizations opened the session at 10:30 a. m. and turned the meeting over to E. S. Mansfield, as manager for the day. Mr. Mansfield said that a better feeling as to business exists throughout the country and now is the time to prepare for future campaigns. Mr. Miles, of the Boston Edison Company, announced that passes were available for visitors to inspect the garages and service station, and many took advantage of the opportunity between sessions.

Day Baker, chairman, predicted a great impetus to business the coming year. The electrical industry has shown its confidence in the electric vehicle and pointed the way for other industrial firms to follow. C. F. Smith, of the Boston Edison Company, reported 14 months as the life of thin-plate batteries in emergency service of the Boston company. Mr. Baker said that customers other than central stations often get better work from batteries than do the latter.

Fred B. Neely, of the Electric Storage Battery Company, gave some interesting data respecting Ironclad batteries. One such is now in its fourth year of service and has run 35,000 miles. Thin-plate batteries have a life of 350 to 450 working days and run up to 8,500 miles, the negative plates lasting 630 days. The best mileage is obtained by getting full day's work out of the vehicle.

Mr. Smith held that the life of batteries should be reckoned in cycles, or gassing periods.

J. F. McDonald, of Cambridge, told of Ironclad batteries which have run 30 months and 20,000 miles. They were thoroughly cleaned after 18 months and are good for a total of 3.5 to 4 years.

Mr. Neely spoke of the general tendency of central stations to increase the size of conductor for garage service. A member described a new device for removing the elements from battery jars, which practically eliminates breakage. The danger of breakage in trucks which are regularly backed against a platform was considered, and means of obviating the difficulty were mentioned: The adoption of the flexible jar, or the solid lead connection replaced with copper, lead-coated. The standardization of batteries at 42 or 44 cells was advocated, it being pointed out that the cost of charging is as great for a 24-cell battery as for one of 44 cells.

R. B. Daggett, Boston, suggested that in charging by the constant-potential method, vehicles should be put on charge at 10 or 11 p. m. and escape the station peak load. At Salem and Manchester, N. H., a specially low rate is offered after 10 o'clock. Advantages of direct-connected two-motor drive were explained.

Mr. Smith said the best method of treating a chain of chain-drive-type cars is to remove it, boil it in caustic solution an hour, immerse in tallow and beeswax, and replace it. Heavy cylinder oil should be applied daily.

The Amoskeag Manufacutring Company, Manchester, N. H., has devised a chain cleaning and lubricating device, consisting of a cylinder which runs the chain through a bath of oil. The company has two sets of chains for each vehicle and changes them each week.

W. M. Thayer described a plan by which his company, the Hartford Electric Light Company, pays a dividend to each purchaser of an electric car in the territory. If a man buys a 750-pound truck he is given $4 multiplied by the whole number of electrics delivered in Hartford during 1915; if he buys a five-ton truck he is given $14 on each electric delivered in Hartford during 1915. Cars of intermediate capacities carry varying premiums. This gives an incentive to electric-car users to boost the game, and the central station thus shares the profit derived from its service with new purchasers. There are 61 trucks in Hartford. They are cared for and garaged at $2 a week by a company organized for the purpose. The Hartford central station supplies charged batteries at a fixed rental price.

A plan soon to be introduced by the Buzzards Bay Company is to have garages fix charging rates on a par with the retail price of gasoline, and sell energy to the garages on a par with the wholesale price of gasoline. This plan enables the garage owner to make an equal profit on electric vehicles and those of the gasoline type.

C. H. Miles said a charging station is located in every large town in Southern New England. A list is soon to be issued in pamphlet form.

Mr. Cook held that up-to-date electric cars consume only about half the energy formerly required.

Costs of electric motor cars came in for animated debate. Members wished to see prices reduced so as to place the electric within the reach of all.

E. W. M. Bailey, of Amesbury, pointed out the difficulties of producing electrics on the Ford plan. Standardizing parts would greatly reduce costs.

Mr. Sawyer, of Salem, thought manufacturers of pleasure cars paid too much attention to feminine tastes. He suggested the manufacture of a serviceable car for business purposes, good for 30 miles or more on a charge, with more cells and fewer plates. Let higher-voltage motors be employed and save resistance.

At a meeting of Class A members changes in the constitution of the association were approved, and it was voted to fix a registration fee for the annual convention at $3.

Friday Afternoon Session.

At the afternoon session, A. F. Townsend, Woonsocket, R. I., presented figures showing operating costs of two Bailey electric runabouts employed in company service by the superintendent of the Pawtucket Division of the Blackstone Valley Gas & Electric Company. Maintenance and operation costs for both cars for the year 1914 were as follows:

	Cost.	Cost per mile.
Direct Current at 3 cents per kilowatt-hour	$603.96	$0.0173
Tires	827.93	0.0238
Repairs	807.86	0.0232
Operating Labor	237.28	0.0068
Distilled Water	35.62	0.0010
Battery Solution	18.75	0.0005
Total operating and maintenance	$2,577.00	$0.0739
Miscellaneous Expense	45.60	0.0013
Fixed Charges:		
Depreciation at 12.5 per cent	$557.50	$0.0159
Interest at 6 per cent	267.60	0.0076
Insurance	95.00	0.0027
Total fixed charges	$920.10	$0.0262
Total expenses	$3,497.10	$0.1001
	Runabout A.	Runabout B.
Days in service during year	336	337
Total mileage	14,822	20,041
Average miles per day	44	60
Total kilowatt-hours	9,161	10,971
Average kilowatt-hours per mile	0.62	0.55

Figures on the cost of operation and maintenance for a 1,000-pound Baker electric delivery wagon operated in Woonsocket, were: for January, 1915, a total of $178.82, including fixed charges. For 25 months to February 1, 1915, $2,257.26, or 15.53 cents a mile. The truck ran 14,426 miles in all. Operating costs per mile were: tires, 1.35 cents; current at 3 cents, 2.44; oil and waste, 0.004; rectifier tubes, 2.13; labor, 0.51; insurance, 1.51; supplies, 1.48; labor of maintenance, 2.66; fixed charges, 2.90 cents.

P. D. Wagoner, of the General Vehicle Company, said the business is moving forward despite present business conditions. Hindrances to a fuller appreciation of the advantages of these vehicles are the lack of knowledge of their simplicity and economical maintenance, the feeling that the electric is still in an experimental stage; and dearth of data on the performance of electric trucks as compared with gasoline cars and horses. The fact that 60 per cent of orders are repeat orders is proof that those who know the electric appreciate its merits. Mr. Wagoner thought the time not yet come when a low-cost, efficient electric can be produced. It might be possible to produce a light, cheap electric for present users who know how to handle the storage battery car.

Many lighting companies do not appreciate the profits they might derive from off-peak charging. Little added investment is required, and the noon valley as well as the night period could be utilized. Unit costs are often higher on cars operated by central stations than those owned by other concerns, due to long stand-still periods when out on line work.

F. H. Smith, Worcester, stated that the lighting company in that city is ready to assist purchasers of cars to pay for machines bought on the instalment plan. Mr. Smith presented figures showing operating and maintenance costs of company machines in size from a 7,000-pound cable truck down to runabouts. Including energy at 2 cents per kilowatt-hour, the costs ranged from 60.6 cents per car-mile to 11.3 cents, based on 18 months' records. The high cost per mile of the cable truck was due to the long periods of idleness while on line work.

Speakers pointed out the advantage of boosting charges at noon when snowy roads have to be traversed. Under such conditions energy consumption may be increased 30 per cent, but full daily mileages are readily maintained.

C. F. Smith, of the Boston Edison Company, said that by reducing the sprocket and ratio of gear in snowy times, better mileages can be secured. Another speaker said that by giving a battery an overcharge twice a month, one not fully discharged daily will give rated service. Mr. Skinner, of Providence, held that by keeping spare controller parts on hand, protracted delays in service can be obviated.

Day Baker, of the General Vehicle Company, thought manufacturers of trucks cannot afford to give trial service to prospective purchasers, for any long periods. In reply to questions as to the weight of trucks, he mentioned instances where machines have been greatly overloaded.

Operating and maintenance costs of two Bailey roadsters owned by the Malden Electric Company showed an outlay, including fixed charges, 11.5 and 12 cents a car-mile. The period covered was six months.

W. O. Adams, of the Eldridge Manufacturing Company, said about 50 electrics in fire-department service are now being operated, principally in Philadelphia, Pa., and Springfield, Mass. The electric so employed is an object lesson and an advertisement. The excellent care of these machines, the fixed routes and the comparatively low mileage requirement, show these cars under favorable conditions. The service is reliable and satisfactory.

The chairman said the Springfield apparatus is being run with the original batteries, though in service several years. Interchangeable trays carry the batteries, one extra tray being kept in each engine house as a reserve. Each battery is completely discharged weekly.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS.

Convention in New York City, March 23-25.

(By Special Telegraph.)

The biennial convention of the National Association of Electrical Inspectors opened on Tuesday morning of this week with an attendance of 45 members at the first session. President Thomas Henry Day called the session to order at 10:45 a. m., and immediately delivered his presidential address.

He referred to his four years' work as president of the Association. Throughout it has been the aim to make the Association truly national. Its activities have been broadened out, and now six sections have been organized. Mr. Day recommended extending the work still further by creating new sections, and he proposed the appointment of a committee to further this work. Provision should also be made for foreign members. He urged members to send questions respecting interpretation of the Code freely to the secretary. The sections should receive more papers from the members and these should be forwarded to the secretary for publication in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN. President Day had appointed C. W. Mitchell as delegate to the World's Insurance Congress to be held at San Francisco this year. In concluding his address, Mr. Day suggested that a salary be set aside for the secretary.

The president's address was referred to a committee, consisting of W. L. Smith, C. A. Hannan and J. B. McCarthy. New members of the Association were elected as follows: R. S. Graham, Stamford, Conn.; John W. Kelly, Jr., Camden, N. J.; Henry G. Schaub, Paterson, N. J.

The report of Secretary-Treasurer W. L. Smith was then presented. This showed there was a balance on hand in the treasury of $12. The Association now has 278 active members. During the past two years 112 questions have been received by the secretary, and of these 75 were sent to the Executive Committee and answered by its members. Mr. Smith referred to frequent discrepancies in the answers received, and the desirability of publishing them as received rather than editing before publication. The report was accepted.

Eugene N. Davis then presented a brief oral report of the work of the Executive Committee, of which he was chairman.

Election of officers was then taken up. President Day declined a renomination as president and also as representative on the Electrical Committee. The election which ensued, and which was unanimous, resulted as follows:

President, H. S. Wynkoop, New York City.

Vice-President, Washington Devereux, Philadelphia, Pa.

Secretary-Treasurer, William Lincoln Smith, Concord, Mass.

Representative on Electrical Committee, R. P. Strong, New Orleans, La.

The discussion of proposed changes in the Code was then taken up, and the question of approving concentric wiring was discussed by George L. Collison, Arthur Lewis, J. B. McCarthy and W. L. Smith. It was thought by most of the speakers that it would be difficult to get proper installation and good grounds. A motion was passed to support the report of the Committee on Grounded Concentric Wiring Systems, which is a subcommittee of the Electrical Committee N. F. P. A., and which had recommended that no rules or amendments to the National Electrical Code covering the subject be adopted at this time.

The remainder of this session was given over to discussion of the first proposed amendment to Rule 23*d*, requiring a cabinet for the installation of switch and cutout. No definite action was taken on this point, however.

The afternoon session opened with the report of the Committee on the President's address, which was presented by W. L. Smith. The recommendation for a committee on section organization was approved, and also that action be taken to admit foreign members. This report was adopted.

The discussion of Code questions was then continued. Proposed changes in Rules 35*a* and 35*b* were first taken up, but no action was taken. Further discussion then ensued on the proposed change in Rule 23*a*, in connection with the fifth proposed amendment to the same rule, and also the fifth amendment to Rule 24*a*. There was general approvel to the use of a cabinet, but objection to eliminating the cutout in front of the switch. No final action was taken, however.

The motion was carried providing for the appointment of a committee consisting of W. L. Smith, John T. Pownall and O. E. Smith, to draw up an amendment for future revision of the Code requiring a cutout on remotely located polyphase or split-phase motors, which would disconnect all phases when one is opened. The inspectors cited many cases in which opening of one phase caused overheating of motor and subsequent burnouts.

The discussion was then taken up of the first amendment proposed to Rule 30*a*. No final action was taken on this. Rules 72, 77, etc., relating to sockets for grounded systems, were then taken up. It was stated that the proposed amendments to these rules have no reference to concentric wiring, which subject was further discussed. A motion was passed favoring the third amendment to Rule 32*e*, permitting the use of flexible cord for temporary displays in show windows. The proposed change to Rule 12*b*, permitting cables for surface loops, was favorably discussed. Triplex cable is already being used in New York City and elsewhere with good results. The various practices in connection therewith were discussed. A motion was passed to support this proposed change in the rules.

The banquet held in the evening was attended by nearly 100, and was a very delightful affair. Credit for the arrangement was due to Alfred E. Bradell of the Sprague Electric Works. J. C. Forsyth acted as toastmaster. Speeches were made by President Day, President-elect Wynkoop, Theodore I. Jones, William Lincoln Smith, J. E. Latta, Calvin B. Roulet and George E. Bruen.

Many tributes were paid to James E. Cole, representative of the Association on the Electrical Committee, who was unable to be present. A motion was passed expressing the sentiment that the services of Mr. Cole should be retained on the Electrical Committee in some other capacity. A unanimous vote of thanks was passed for President Day for his valuable services to the Association. Mr. Wynkoop spoke strongly in favor of making the Association international in scope, and of holding annual instead of biennial meetings.

T. I. Jones, of the Brooklyn Edison Company, told why the central stations were anxious to secure concentric wiring. They must have increased load on account of the steadily increasing lamp efficiencies. Mr. Forsyth was in favor of concentric wiring, not in order to cheapen the cost of wiring, but to permit greater increased use of electricity, which is the safest form of light and power.

Everyone in attendance at the convention was unanimous in the opinion that it was the best and largest attended convention the Association ever had. Wednesday and Thursday were spent by the members in attendance at the meetings of the Electrical Committee. During the committee meeting on Tuesday morning, Washington Devereux suddenly became ill and had to be taken home to Philadelphia; this was the only unfavorable feature of the entire convention.

For the first six months of operation of the Coon Rapids hydroelectric development, under lease to Minneapolis General Electric Company, the output of the generating station was 16,651,860 kilowatt-hours.

Electrical Supply Jobbers at Hawthorn.

One of the most interesting features of the meeting of the Electrical Supply Jobbers' Association which was held at Chicago, March 17, 18 and 19, was the trip on Friday afternoon of the jobbers and their friends to the Hawthorn Works of the Western Electric Company. The illustration herewith shows the big group assembled at Hawthorn. As was pointed out in the last issue, the meeting was noteworthy in point of attendance of the leading representatives of electrical manufacturers, who held an important joint session with the jobbers on Thursday morning. At this meeting pertinent business topics were discussed very frankly and able addresses made by W. W. Low, president of the Electrical Appliance Company, Chicago; H. B. Crouse, president of the Crouse-Hinds Company, Syracuse, N. Y.; J. C. Bridgeman, general manager of the Hazard Manufacturing Company. On Thursday afternoon a paper was presented by Mr. W. N. Matthews, president of W. N. Matthews & Brother, St. Louis, Mo.

The meeting of the executive committee on Wednesday evening reelected Franklin Overbagh general secretary and T. M. Debevoise was continued as general counsel of the association.

Business and Technical Experts Meet on Concentric Wiring.

(By Telegraph.)

At the Biltmore Hotel, New York City, on March 23, 1915, was held the first meeting of the representative committee of business and technical experts elected on March 9, 1915, by the manufacturers of electrical supplies and materials entering into electrical construction, under the following resolution:

"Resolved, that a representative committee of business and technical experts be appointed to investigate the all-insulated system of building wiring as used at present in this country, and coincidently investigate grounded return systems together with concentric wiring:

"First:—To determine the relative efficiencies of the two systems.

"(A)—As to safety to persons.

"(B)—As to protection against fire.

"(C)—As to the possible provision of methods of wiring at low cost, combined with ease of installation and sufficiently attractive appearance to obtain popular approval.

"Second:—To present to the entire industry the results of its investigations in the form of concrete recommendations, including standard systems, standard devices, and standard appliances."

After extended discussion of the work assigned to them, the committee decided that the first and basic question must be the determination of the relative efficiencies under headings (A) and (B) of the above resolution.

First:—Present system of insulated circuits in buildings.

Second:—Grounded return circuits.

To give to the committee a sound basis for further procedure, the following gentlemen were elected as a subcommittee to immediately collect available data as to the advantages and disadvantages of grounded-return systems for building construction:

C. E. Corrigan, National Metal Molding Company.

W. H. Blood, Jr., National Electric Light Association.

G. S. Lawler, Associated Factory Fire Insurance.

J. R. Strong, Tucker Electrical Construction Company.

S. W. Stratton, Bureau of Standards, Washington, D. C.

D. C. Jackson, Massachusetts Institute of Technology.

The wide-spread effect of so radical a change in American wiring systems as would result from the complete adoption of grounded returns causes the committee to begin its investigations by thoroughly sifting the supposed theoretical advantages of that system, and so far as possible obtain authentic data of the results obtained in England and

Group of Jobbers at Hawthorn Plant of Western Electric Company—Left Hand.

Europe where the grounded returns have been used to some extent.

Until the committee secures permanent headquarters, those interested in this subject are invited to address communications to the committee, care of Leroy Clark, chairman, 114 Liberty Street, New York City.

Flow of Energy Through Transmission Lines.

A joint meeting of the Chicago Section, American Institute of Electrical Engineers, and the Electrical Section, Western Society of Engineers, was held in Chicago on the evening of March 22 at which Paul M. Lincoln, president of the American Institute, acted as chairman.

Robert A. Philip, of the Stone & Webster Engineering Corporation, read a paper entitled "The Flow of Energy Through Transmission Lines." This paper described a new graphical method of representing flow of energy which is applicable to practically all forms of energy, but was developed particularly to elucidate the conditions in electrical circuits. The method makes use of two ribbons, of which one represents the flow of energy proper and the other (drawn with a web at right angles to the former) represents reactive power, commonly misnamed wattless power. The direction of the ribbon shows the direction of the energy and the width of the ribbon is proportional to the amount of energy passing at any point. Energy losses at various points in the circuit are shown as branches from the main ribbon proportional to the losses. Mr. Philip uses the term magnetizing power for all reactive power, denoting condensive or charging power as negative magnetizing power.

Electric Prosperity Week Launched by Society for Electrical Development.

The Executive Committee of five appointed for the Society for Electrical Development, Incorporated, to handle the details of a national campaign for an Electric Prosperity Week held an important meeting on March 24, at the Railway Club, New York City. The members of the Executive Committee of five are A. W. Burchard, vice-president, General Electric Company, and chairman of the committee; Gerard Swope, vice-president, Western Electric Company; J. R. Strong, Tucker Electric Construction Company; Frank H. Smith, vice-president, United Electric Light and Power Company, New York; Hugh M. Wilson, vice-president, McGraw Publishing Company; and associated with these are J. M. Wakeman, general manager, Society for Electrical Development; H. W. Alexander, manager, department of publicity; and George B. Muldaur in charge of the engineering field developments of the society.

Following an interesting discussion and considering several previous meetings with other prominent men of industry, and further considering the sentiment and all conditions affecting central stations, manufacturers, jobbers, contractors and dealers, the executive committee decided upon the week including December 1, 1915. The exact date of opening will probably be November 27. Indications point to tremendous activities, with the whole electrical industry moving forward in a united front. A resolution, as follows, was passed.

Jobbers at Western Electric Company Plant—Right Hand.

"Resolved, That under the general guidance of this committee the full responsibility for conducting the electrical week be, and is placed upon the general manager and staff of the Society for Electrical Development. It is understood that the general manager will call upon various individuals to act in an advisory capacity to the general manager and his staff."

The committee will name local committees for different cities in geographical centers, and 50 of the most prominent men, representing different interests in the industry, will act. The executive committee will call a special meeting for April 7 to consider a budget to carry on this work.

New Electrical and Mechanical Appliances

The Vanitie Portable Lamp.

A new portable electric lamp, having many novel features, has recently been offered to the trade under the name Vanitie. A felt-lined clamp that pulls out of the base allows the lamp to be securely fastened to a chair, dressing table, bed post, sewing machine, etc. A rubber suction cup, concealed within the base, fastens the lamp to any smooth, polished non-porous surface. This suction cup has an automatic release attachment, enabling one to destroy the vacuum instantly, when desirous of moving the lamp from its position. The adjustable and detachable shade fits any size or style of globe,

Vanitie Portable Lamp.

and can be turned to practically any angle to insure concentration of the light. The inside of the shade is coated with a satin-finish aluminum to reflect a soft light.

The vizor joint permits the bending of the lamp into any position, and no matter to what extent the neck is tilted, there is no exposure of the cord; the lamp is movable rotatably, so this joint is practically universal. Ten feet of high-grade parallel cord is wound inside the base, and only the amount required need be drawn out when the lamp is being used. The socket used is the new Cutler-Hammer push-button type, and the attachment plug is the Benjamin, having the swivel feature, which prevents the cord from twisting.

The lamp is constructed of brass throughout, and is finished in old brush brass and nickel plate. The height when standing erect is twelve inches; the weight is about one and one-half pounds, this being so light that the outfit is easily packed for traveling. It is manufactured by the Aladdin Lamp Corporation, 111 Broadway, New York City.

Locating Bullets Electrically.

The Hughes induction balance is being successfully applied in Europe for the location of bullets and shell fragments in wounded soldiers. It may not be generally known that this marks a revival of an old and well known application of a historical piece of apparatus, which should prove of inestimable value in the field in the absence of radiographic facilities. It was first employed for this purpose at the time President Garfield was shot, after other methods of locating the bullet had failed. The idea of using the instrument in this way originated with Alexander Graham Bell.

The Hughes induction balance consists essentially of two pairs of coils, respectively primary and secondary windings. The coils of each pair are equal in magnetic effect, and in making up the balance they are paired as primary and secondary, the primaries and secondaries respectively connected in series, but constituting separate and independent circuits.

In circuit with the primaries is a battery or other source of current and some form of interrupter such as a microphone. The secondary coils are connected to a telephone receiver, and are so disposed in relation to the primaries that the induced currents generated in them by the current variations in the primary circuit exactly neutralize one another.

Under such circumstances the telephone receiver will be silent. If, now, one of the pairs of coils is brought near a mass of metal, the inductive balance is upset, and a sound will be heard in the receiver.

For use as a bullet locater, one pair of windings is used as a search coil, and applied to various parts of the body in the vicinity of the wound. As soon as the coils approach the bullet, the telephone receiver commences to sound, and by careful manipulation a spot can be found, immediately over the bullet, where the sound is loudest. To detect the depth at which it lies hidden, a second bullet, of equivalent mass, is brought near the fixed coils of the balance until equilibrium is restored and the telephone silenced.

"Best" Composition Sign Receptacle.

A new design receptacle, made of a tough, durable asbestos composition, has been placed on the market by the Best Electric Company, of Pittsburgh, Pa. This receptacle is made particularly to withstand the rigors of outdoor service. The makers claim that this asbestos composition is absolute proof against both fire and water, that is cannot melt and cannot absorb moisture. It is also said that this composition assures uniformity in size, so that the spacing is always the same. There is no variation in size as with porcelain, and the receptacle cannot crack.

Another feature is the fact that the nuts are molded permanently into place

Composition Sign Receptacle.

so that they cannot work loose. Also, the interior screw shell is interchangeable, and is removed by simply turning back two screws.

Edison to Make Benzol.

It is announced that Thomas A. Edison has opened a factory in Johnstown, Pa., for the manufacture of benzol from coal gas, a process never before developed in this country. Carbolic acid and aniline dyes are made from benzol, which heretofore have chiefly come from Germany. Since the war there has been a great shortage of this product, and chemists and manufacturers have given much attention to producing it here.

New Direct-Current Motor.

The new type C direct-current motor just announced by the Robbins & Myers Company, Springfield, O., is at present made in sizes from one-eighth to three horsepower, inclusive. The frame is cast iron, and of low, squatty shape, adapting the motor for installation where space is restricted. The bearing bracket on the commutator end extends well out from the frame and gives easy access to the commutator and brushes. The bearings are oil-ring lubricated and the oil reservoirs are equipped with overflow and drain plugs.

New Type of Robbins & Myers Direct-Current Motor.

These motors can be furnished open or fully inclosed, horizontal or vertical, for continuous or intermittent service, constant or variable speeds, shunt, series or compound wound. They are made for 115, 230 and 500-volt circuits, also for service on low-voltage storage-battery circuits. Each motor is regularly furnished with sliding base, no-voltage-release starter and cast-iron crown pulley. They can also be furnished with idler pulleys or back-gear attachments, if desired.

Electric Gear Shifting Adopted for Well Known Automobiles.

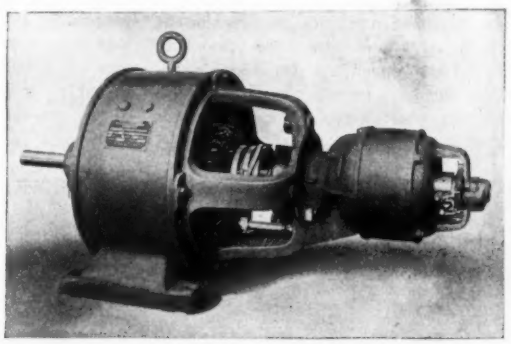
The Vulcan electric gear shift made by The Cutler-Hammer Manufacturing Company, of Milwaukee, has already been adopted by some of the best known automobile manufacturers of the country. Definite announcements have been made that the electric gear shift will be furnished on the Winton, Jeffery, L. P. C. and Pullman cars when specified. Several other prominent automobile manufacturers, the names of which cannot be mentioned at this time, are preparing to supply this device with their cars in the future.

The electric gear shift makes it possible to shift gears at will with almost no physical effort and without taking the eye from the road. It does away with the lever and permits changing gears by means of push-buttons located on the steering wheel. It is as easy as pushing the horn button. This greatly simplifies the car control, adds to the safety and increases the pleasure of driving. The great success in the use of electricity in the lighting and cranking of the gas car has paved the way to the further utilization of the electric power plant with which the modern automobile is equipped by employing this energy to shift the gears. An illustrated description of this device was published in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of March 21, 1914.

Small Belted Alternator.

The term "generator" to many minds brings up the vision of huge turbo-alternators, equipped with the most elaborate devices to insure absolute reliability. Yet there are hundreds of small plants the demand of which does not warrant the use of such huge units but where reliability is just as important.

For such service the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has perfected a small belted alternating-current generator with direct-connected exciter. Such an arrangement makes a very compact unit, as well as securing reliability and independence of operation.



Small Westinghouse Alternator with Direct-Connected Exciter.

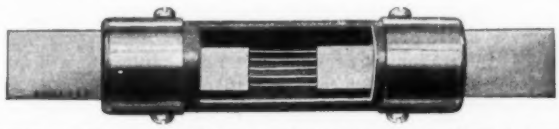
This generator has a rated capacity of 20 kilovolt-amperes, three phase, or 14 kilovolt-amperes, single phase. The standard frequency is 60 cycles at a speed of 1,800 revolutions per minute and the machine can be furnished to give either 120, 240, 480 or 600 volts.

Chelten Inclosed Fuses.

The Chelten Electric Company, Philadelphia, Pa., has recently designed and placed on the market a new National Electrical Code inclosed fuse. The manufacturer claims this product to be of the highest quality, and up to the usual high standard of all Chelten specialties. In designing this fuse it was realized that the requirements of a fuse are exacting.

The new fuse is of uniform rating, blowing strictly in accordance with the underwriters' requirements. At normal temperature it will carry indefinitely 10 per cent greater load than rated capacity, and is calibrated to blow uniformly at 17.5 per cent overload, this percentage being a mean between the standard limits of 10 per cent minimum and 25 per cent maximum required by the underwriters. Extreme care is taken in the manufacture to see that this accuracy is carefully preserved.

Chelten Ferrule-Type Inclosed Fuse.



Knife-Blade-Type Cartridge Fuse with Shell Cut Away to Show Element.

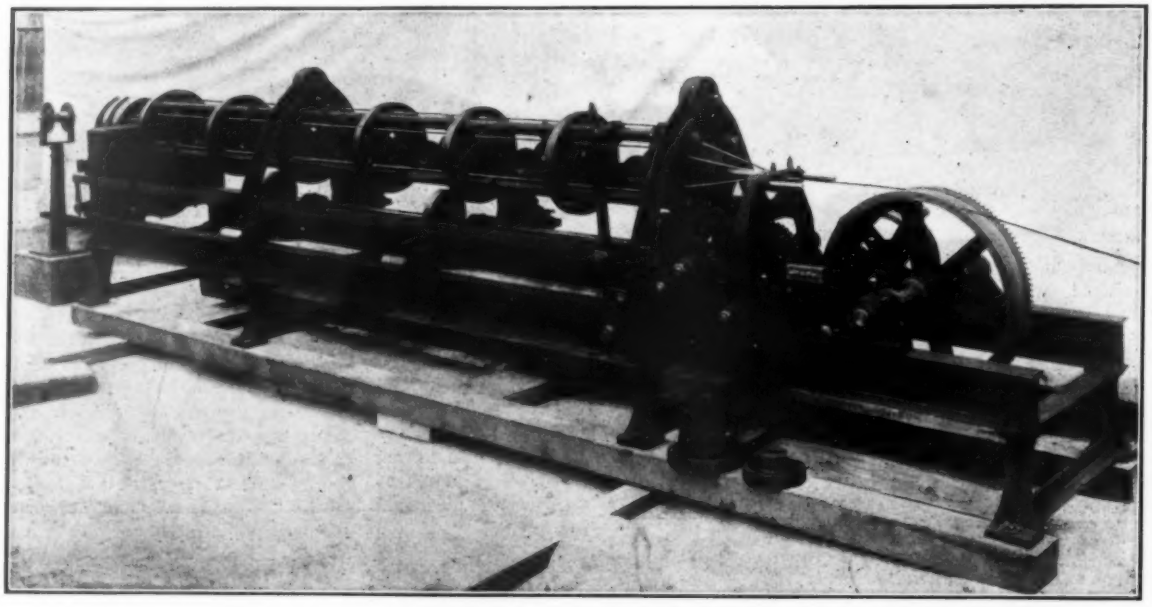
The fuse strip used in all Chelten fuses is of round wire drawn through a die, which is more accurate than flat material which cannot be rolled as close to specifications. All fuses above 35 amperes have a fuse element consisting of three parts: two "lead-in" strips of flat fusible material, and the center fuse strip or strips connected to these lead-in strips. These round center strips determine the rating of the fuse on regular overload, but on a short-circuit both the center and lead-in strips blow,

increasing the arcing distance and thus making it easier for the filler to extinguish the arc.

These fuses are made in all standard sizes up to and including 600 ampere, in both the 250 and 600-volt types. The Chelten Company is also in a position to deliver most of the old Code types of fuses, as well as automobile and midget fuses.

New Machines for Stranding Wire.

A new line of stranding machines has recently been brought out which will be of interest to manufacturers of insulated wires, as these machines are capable of much higher speed than those previously built. These machines are suitable for making the bare copper strands and also for laying up insulated wires or strands into cables.



New Type of Wire-Stranding Machine.

The illustration shows a seven-reel machine taking spools seven inches to nine inches in diameter, and capable of runing at 800 revolutions per minute. Smaller machines of this same type for fine wires are built running as high as 1,300 revolutions per minute, also large machines taking wire spools up to 32 inches in diameter.

To maintain these very high speeds the machines are very accurately balanced and equipped with ball bearings. The main bearing and driving gears are inclosed in oil-tight cases so that thorough lubrication is insured.

Machines are built in two-head tandem form, consisting of 7 and 12-reel sections, and also in single-head form with as many as 19 reels in one section. These machines are built by the New England Butt Company, Providence, R. I.

A Vibration Electrometer.

Any alternating-current measurement which makes use of a null method requires an instrument which will detect small alternating currents or voltages. One of the first instruments used for this purpose was the telephone. This is very sensitive between the frequencies of 500 and 3,000 cycles per second, but at frequencies below 500 cycles the sensitiveness decreases rapidly with the frequency, so that it is very insensitive at frequencies below 100 cycles. It also responds to the harmonics of the current as readily as to the fundamental.

As a null instrument, a vibration galvanometer is often much more satisfactory than a telephone. The moving system of a vibrating galvanometer is adjusted to have the same period as that of the current to be detected, so that any harmonics in the current produce very little effect upon the deflection of the instrument. Also most vibration galvanometers have their maximum sensitiveness at low frequencies (50 to 200 cycles) though at least one form may be had which will go to frequencies as high as 3,000 cycles. Since the impedance of these instruments is relatively low, they require an appreciable current to produce a deflection which can observed. Hence in bridges where the impedance of the arms is very high, they are not very sensitive.

The vibration electrometer described in Scientific Paper No. 239, recently issued by the Bureau of Standards, Washington, D. C., was designed as a vibrating instrument having an impedance much higher than a telephone or vibration galvanometer. The need arose in connection with the measurement of some very low capacities at low frequencies. Its usefulness is limited to those cases where it is desired to detect very small currents at low frequencies. Its principal use is as a detecting instrument in a bridge having very high impedances in the arms.

The instrument is a modification of a quadrant electrometer. Instead of the quadrants there are four vertical plates, while a thin vertical vane of twice the area of a single plate corresponds to the needle of the electrometer. Two plates, separated by a narrow vertical slit, are in one plane, while opposite them in a parallel plane are the other plates. Midway between the planes is the aluminum vane, which is suspended by a bifilar suspension. This vane is maintained at constant potential by a battery, while an alternating voltage having the same period as the natural period of the vibrating system is applied to the plates. This causes mechanical forces to be applied to the vane due to electrostatic attractions and repulsions which will set the vane in vibration. Since these forces are small, it is necessary that the damping shall be small. In addition to so designing the suspension that there is very little loss of energy in it, it is necessary to keep the instrument in a vacuum.

The form of the instrument is such that the capacities can be approximately computed. Hence it is possible to develop the mathematical theory of its behavior. This has been done and the conclusions reached have been checked by experiment. The important conclusions are as follows:

1. The frequency at which maximum deflection is obtained depends upon the potential of the vane. As the potential of the vane is increased, the frequency at

which maximum deflection is obtained is decreased.

2. The deflection for a given voltage is inversely proportional to the damping.

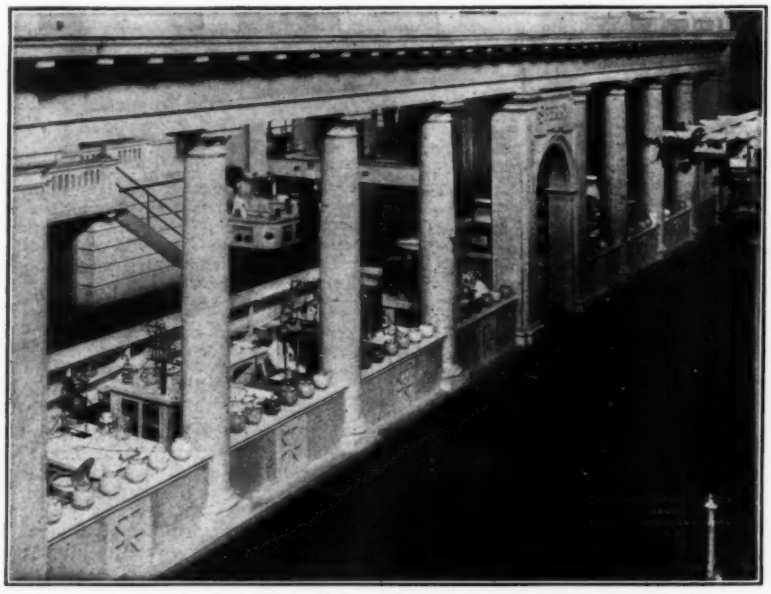
3. As the damping is decreased, the tuning becomes sharper.

4. The power required to give unit deflection when the applied electromotive force is in reasonance with the instrument decreases in the same ratio as the damping.

Experimentally it has been found that the instrument will detect a current as low as 10^{-21} ampere.

Exhibit of Hughes Ranges and Ovens at San Francisco.

One of the interesting exhibits at the Panama-Pacific International Exposition is that of a large equipment of Hughes electric ranges and a Hughes electric bake oven in actual use in connection with the exhibit of the Sperry Flour Mills Company. The Sperry Flour Mills Company is the largest flour manufacturer on the Pacific Coast, with seven mills from Tacoma to Los Angeles.



Joint Exhibit of Hughes Electric Heating Company and Sperry Flour Company.

The joint display occupies 6,600 square feet of floor space. It includes a three-story flour mill in operation, with a daily capacity of 90 barrels of flour. a modern bakery in operation; a chemical test and comparative baking laboratory with scientists at work; and ten demonstrating booths, nine of them devoted to the methods of baking and serving breads and cakes.

Each of the nine booths has a different type of electric range made by the Hughes Electric Heating Company, of Chicago.

Perhaps the most spectacular feature of this unique series of exhibits covering the "staff of life" in its evolution from all grades of wheat to scientifically perfect bread and pastry, is the six booths of "All Nations," each presided over by cooks and waiters, natives of many countries, in characteristic costumes.

Of the other three booths, one is operated to demonstrate how flour is used in the American home for the various kinds of bread, cake and pastry. The second shows how the cooks of the Southern States make hot biscuits, corn pone, Maryland biscuits, and hot cakes. The third is used for demonstrating the purity, food value and the new and economical uses of cereals.

Half a dozen American girls, with some years' experience as kitchen experts, are on hand to demonstrate electric cooking in connection with the Hughes exhibit. A large force of trained people, chosen from the regular employees of the Sperry Flour Company, scientists and practical teachers, are at the service of the visitors.

A portion of the exhibit is a miniature laboratory and here a Hughes "45" oven is used. In the flour booth, which is seen by the spectator as he passes through the ornamental archway at the entrance of the exhibit, is a Hughes "150" bake oven in operation. At the right of the flour booth, and occupying the same relative position to the spectator on entering is the cereal booth, in which a Hughes "60" electric range is operated.

Along the right hand side of the exhibit are the Chinese, Japanese, Colored and Spanish displays, where are shown respectively a Hughes "40" range, and shelf, a Hughes "17" range and oven, a Hughes "30" range, and a Hughes "44" range. The "17" range is used in the Japanese booth because most of the Japanese national cooking is done over an open fire, and there is very little baking.

The Sperry-Hughes exhibits thus are vastly more than a mere display of flours, feeds, cereals, machinery and cooking apparatus. With a three-story mill divested of walls and displaying in detail the modern mill machinery turning out 90 barrels of flour and other wheat products every day; with a perfectly appointed bakery running full blast; with a corps of food chemists at work; with young lady demonstrators of kitchen management, and farm experts, giving practical instructions—this series of exhibits will take its place as one of the most instructive and important displays at the exposition.

New Millinery Pliers.

Mathias Klein & Sons, manufacturers of linemen's, electricians' and construction tools, Chicago, Ill., have placed on the market two new designs in millinery pliers.

These new tools have been created,

New Types of Millinery Pliers.

to meet a widespread demand for pliers which will effect a clean cut without breaking silk-covered wire and with safeguards against the possibility of the wire becoming caught in the joint. This desirable essential is accomplished by means of lap-joint construction as opposed to the box-joint pliers.

These pliers are made of the same quality of tool steel, hand forged, which characterizes all Klein pliers.

The Allgemeine Elektricitats Gesellschaft, of Berlin, Germany, which is one of the largest electrical manufacturers, in the world, produced during its last fiscal year (ended June 30, 1914) a total of 123,162 dynamo-electric machines and transformers with a rating of 1,840,000 kilowatts.

Current Electrical News

ATLANTIC STATES.

PEN ARGYL, PA.—A large new Y. M. C. A. building, financed largely through the co-operation of the Lehigh and New England Railroad Company, will be erected here. The electrical installation will be of the most modern type.

PITTSBURGH, PA.—It has been announced here that the Carnegie Steel Company will shortly begin the construction of a $500,000 steel-tie plant at Homestead. The electrical contracts will be awarded in the near future. A. C. Dinkey is president.

ATLANTIC CITY, N. J.—Plans have been prepared for a $200,000 six-story extension to the Hotel Strand here. The electrical contracts will be awarded during the summer, and the work will be started in September. George Allen, of Philadelphia, is proprietor and Howard Edwards is manager.

ATLANTIC CITY, N. J.—Mayor Riddle and Director of Parks Bacharach have directed that costs be obtained for the construction of brilliantly illuminated "White-Way," extending from the Boardwalk to Atlantic Avenue, here. It is expected that the scheme will be made effective before the summer seasons arrives.

WILLIAMSON, W. VA.—The Williamson Light and Ice Company's plant was destroyed in a recent fire which consumed the Williamson Wagon Works, the two plants being out of reach of the fire fighting system. The loss to the light company is said to exceed the insurance carried, which was $32,000. Current can be obtained from other sources while the plant is being rebuilt.

NORTH CENTRAL STATES.

ATHENS, O.—The city council is making preparations for the installation of an ornamental street-lighting system, to cover a number of the streets, on a basis which will provide for its maintenance by the property owners affected. L.

CINCINNATI, O.—The Charles McCaul Company, of Philadelphia, has been awarded the contract for the construction of the Hamilton County courthouse, on a lump sum bid of about $1,400,000, including all electrical power and other equipment. Work on the new building will begin as soon as the old building is torn down. Rankin, Kellogg & Crane, of Philadelphia, are the architects. L.

LIMA, O.—An ornamental cluster-lighting system, extending from the public square to McDonel Street, will be installed by property owners, who petitioned the city council for the necessary authority, which was granted. The posts will be erected at 60-foot intervals, under the ordinance. L.

MASSILLON, O.—Reconstruction of the local exchange is being made by the Ohio State Telephone Company, at a cost of $70,000. The plans, which have just been completed by the engineers at Columbus, include new switchboard, telephones and cables. An automatic connection has been made between this exchange and that at Akron. Improvements will follow at the Canton and Alliance exchanges. J.

PORT CLINTON, O.—The American Plaster Company will substitute electricity for steam power in the operation of all machinery, drills, cars and hoists in crushing. J.

TIFFIN, O.—The Ohio Light and Power Company has completed its line from this city to Fostoria and will continue on to Fremont. Villages along the line will also be served with electricity. J.

BLOOMINGTON, ILL.—A number of business men are back of a movement to install cluster electric lights from the square to the C. & A. station.

RANKIN, ILL.—The Rankin Electric Light Company. Capital $5,000. To manufacture and sell electric current for light and power. The incorporators are Charles J. Crump, Catherine Crump and Charles Morrow.

SPRINGFIELD, ILL.—The city commissioners have ordered advertisements published asking for bids for a 750-kilovolt-ampere generator to be installed at the water works pumping station.

MINNEAPOLIS, MINN.—Plans for improvements by the city of Granite Falls, Minn., to the hydroelectric plant at that place will soon be completed by the Power Engineering Company, Corn Exchange Building (Minneapolis). Hydroelectric equipment to be installed will include a new generator and governor.

SHERBURN, MINN.—The board of public works of this place is to purchase a 220-volt, 25-ampere, eight-hour battery. Equipment for an ornamental lighting system is also to be purchased in the near future.

FERGUS FALLS, MINN.—The Otter Tail Power Company, by the extension of its lines to White Rock, S. D., is installing a complete electric lighting system in that city. Electric ranges and cooking devices are being installed in many of the homes. Under the recent arrangement the small electric lighting system that did service in White Rock will be discontinued.

SOUTH CENTRAL STATES.

DIXON, KY.—Business men of this place are considering a proposition made by C. R. Clark, manager of the Clay (Ky.) Light and Ice Company which would provide for a 24-hour electric service. Mr. Clark proposes to extend a transmission line from Clay, generating the current at the Clay plant. It would be necessary to float a bond issue of $6,000 to meet the expenses of installing an additional dynamo, boiler and construct the transmission line.

MIDDLESBORO, KY.—W. H. Squires, district manager of the Kentucky Utilities Company, has acquired a half interest in the Middlesboro Electrical Works, which has been in existence here for nine months. The company expects to extend its business by adding an automobile repair and fixtures department and will keep in stock duplicate parts of all electrical machinery and appliances used by mining and manufacturing concerns in this district. The company also probably will seek larger quarters.

AUSTIN, TEX.—The legislature adjourned without passing either the bill that provided for placing telephone and telegraph companies under control and regulation of the State Railroad Commission or the bill that provided for the creation of a Public Utilities Commission. D.

FLORESVILLE, TEX.—The electric light proposition which was presented to the city council by B. J. Carrico, of Fort Worth, has been approved by the council, and as soon as the promoter's bond is received a franchise will be granted. It is expected the plant will be completed and in operation in 90 days.

FREDERICKSBURG, TEX.—The Willow City Telephone Company has been organized with principal office here; capital stock, $7,685. Incorporators, Alfred Sagebiel, R. S. Klett and Waldemar Hausen. D.

TERRELL, TEX.—Plans are being prepared for electrifying the Texas Midland Railroad which runs from Paris to Ennis, a distance of 135 miles, according to authoritative information obtained at the general offices of the road here. The Texas Midland is owned by Mrs. Hetty Green, of New York. It is proposed to convert the line into an interurban for the handling of both freight and passenger traffic. The construction of an extension from Ennis to Waco and a branch line to Dallas is under consideration. E. H. R. Green, of New York, son of Mrs. Hetty Green, is president and general manager. D.

MISSION, TEX.—The city commissioners have granted a franchise to Hamilton & Horlock, of Houston, to erect an electric light and waterworks plant at Mission, to cost in the neighborhood of $60,000.

WESTERN STATES.

TACOMA, WASH.—The Mutual Electric Light and Power Company, of Riverside, near this city, has petitioned the county commissioners of Pierce County for a franchise to erect transmission lines along the Inter-County River Improvement, to the King County line, in order that farmers along the right of way may be furnished with current for both light and power. Lorenzo Dow, here, is attorney for the company, and Leonard Westbo is secretary and manager. O.

SPOKANE, WASH.—The Washington Water Power Company, according to M. C. Osborne, an official of the company, will extend its transmission lines from Endicott to La Crosse, by the way of Winona. It is understood active construction will begin this spring. O.

ESCONDIDO, CAL.—The Escondido Mutual Water Company has been granted a franchise to build a power line from its dam to the city.

ANAHEIM, CAL.—The Board of Trade has appointed a committee to investigate the advisability of making changes in the municipal lighting plant.

LOS ANGELES, CAL.—Bonds for a $7,000 lighting system on Main Street have been voted by the Homeward Avenue lighting district. W. Woodward, W. R. House and Jos. McPherson have been appointed to handle the improvement.

LOS ANGELES, CAL.—The Llwellyn Iron Works of this city has been awarded the contract for the construction of government radio towers at San Diego and Honolulu. The price is about $200,000, and the company is given 11 months to complete the work. The towers will be 600 feet high.

PROPOSALS.

ELECTRIC LIGHTING PLANT.—Sealed bids will be received by the Board of County Commissioners of Bismarck, N. D., on April 7, for an electric lighting plant, to be installed in the Court House. Address T. E. Flaherty, County Auditor.

TELEPHONES.—Sealed proposals will be received at the office of the Chief Signal Officer, War Department, until March 29, for furnishing 800 wall telephones and 200 desk telephones. For further information apply to the Chief Signal Officer, War Department, Washington, D. C.

REMODELING FIRE-ALARM SYSTEM.—Sealed proposals indorsed "Proposals for fire-alarm system" will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until April 24, for remodeling the fire-alarm system at the navy yard, New York, N. Y. Specifications may be obtained on application to the Bureau or to the commandant of the navy yard named.

ELECTRIC TRAVELING CRANES.—Sealed proposals will be received on April 10 for electric traveling cranes, at the Bureau of Yards and Docks, Navy Department, Washington, D. C., and for two two-and-one-half ton, three-motor electric traveling cranes, and one movable bridge, delivered and erected at the naval torpedo station, Newport, R. I. Plans and specifications may be obtained on application to the Bureau or to the commandant of the naval station named. Address H. R. Stanford, Chief of Bureau.

FINANCIAL NOTES.

Dividends.

	Term.	Rate.	Payable.
Am. Pub. Util. pf.	Q	1.5 %	April 1
Am. Tel. & Tel.	Q	$2	April 15
Chic. City Ry.	Q	2 %	March 30
Cinn. & Ham. Trac. pf.	Q	1.25%	April 1
Cinn. & Ham. Trac. com.	Q	1 %	April 1
Colo. Spgs. Lt. Ht. & Pr. pf.	Q	1.5 %	April 1
Detroit Edison.	Q	1.75%	April 15
East. Mich. Edison.	—	1 %	April 1
Halifax Elec. Ry.	Q	2 %	April 1
Harrisburg Lt. & Pr. pf.	Q	1.5 %	March 31
Houghton Co. Trac. pf.	S-A	$3	April 1
Ill. Trac. pf.	Q	1.5 %	April 1
Mass. Ltg. old com.	—	$1.75	April 15
Mass. Ltg. pf.	—	$1.50	April 15
Mass. Ltg. new com.	—	$0.25	April 15
Natl. Gas Elec. Lt. & Pr. pf.	Q	1.5 %	April 1
Natl. Gas. Elec. Lt. & Pr. com.	Q	1 %	April 1
New Eng. Tel. & Tel.	Q	$1.75	March 31
Niagara Falls Pr.	Q	2 %	April 15
Ottawa Lt. Ht. & Pr.	Q	1.5 %	April 1
Pac. Tel. & Tel. pf.	Q	1.5 %	April 15
Rep. Ry. & Lt. pf.	Q	1.5 %	April 15
Shawinigan Water & Pr.	Q	1.25%	April 1
Springfield Ry. & Lt.	—	1.75%	April 1

Reports of Earnings.

DETROIT EDISON COMPANY.

	1915	1914
February gross	$ 649,325	$ 553,335
Net	258,684	204,920
Surplus	174,731	134,920
Two months' gross	1,357,704	1,156,661
Net	556,146	443,038
Surplus	388,855	308,009

CITIES SERVICE.

	1915	1914
February gross	$ 388,164	$ 391,259
Net after expenses	375,118	382,228
Balance after interest	334,284	353,061
Surplus after preferred dividends	203,451	216,229
12 months' gross	3,942,500	2,657,931
Net after expenses	3,812,234	2,571,241
Balance after interest	3,368,900	2,389,845
Surplus after preferred dividends	*1,744,906	1,334,333

Accumulated surplus February 28, 1915, $3,881,341.

*Equivalent to 11.32 per cent on common stock.

ELECTRIC STORAGE BATTERY.

The report of the Electric Storage Battery Company for the year ended December 31, 1914, compares as follows:

	1914	1913
*Gross sale	$1,396,793	$1,558,123
Operating expenses	547,165	522,205
Net	$ 848,628	$1,035,917
Other income	254,609	172,837
Total net income	†$1,103,237	$1,208,755
Dividends	649,964	649,964
Surplus	$ 453,273	$ 558,791
Previous surplus	3,312,522	2,855,525
Adj. net	75,728	101,793
Total surplus	$3,690,069	$3,312,522

*Gross sales, less cost of manufacturing, etc.

†Equal to 6.13 per cent on $17,862,500 capital stock, compared with 6.71 per cent earned on $17,845,000 previous year.

PUBLIC SERVICE CORPORATION OF NEW JERSEY.

The Public Service Corporation of New Jersey has issued its report for the year ended December 31, 1914. The combined income account of the Public Service Corporation and affiliated corporations compares as follows:

	1914	1913
*Gross revenue	$38,760,260	$37,279,319
Exp., taxes and amort.	21,196,317	19,852,198
Net revenue	$17,563,943	$17,427,121
Charges, etc.	15,938,606	15,178,922
Surplus	†$1,625,337	$ 2,248,199

*Including miscellaneous income.

†Equal to 6.5 per cent on $25,000,000 capital stock against 8.99 per cent earned on same stock previous year.

PERSONAL MENTION.

MR. A. W. de REVERS will take charge of the Chicago office of the Terry Steam Turbine Company, in the Peoples Gas Building, after March 22. The company has also opened an office in the Michigan Trust Building, Grand Rapids, Mich. This office will be in charge of Mr. A. L. Searles.

CAPTAIN WILLARD L. CANDEE has retired from the presidency of the Okonite Company, of New York, and will take a well-earned rest from active work. He becomes vice-president and continues as a member of the directory, and retains his large interest in the company, which his enterprising and able efforts for 30 years past have so greatly aided in bringing to its present strong and established position in the field devoted to the manufacture of insulated wires and cables. Mr. H. Durant Cheever, former vice-president and treasurer of the company, was elected president to fill the vacancy.

MR. JAMES R. CLARK, JR., head of the James Clark, Jr., Electric Company, as chairman of the Manufacturing Committee of the Louisville Board of Trade, is working with other members of the committee to present a more attractive invitation to outsiders contemplating locating their businesses there. At a recent meeting of the committee it was announced that G. Wilbur Hubley, lately superintendent of the electrical department of the Louisville Gas and Electric Company, has become chief engineer of the Sampson Engineering Company, which will manufacture an electrical starting device for automobiles. This company needs some additional capital to get under way and the support of the committee members was asked in this connection.

MR. D. C. GREEN, well known in western electrical circles, has arrived in Salt Lake City to take the position of division manager of the Salt Lake division of the Utah Power and Light Company's power and electric business. Since leasing the electric light and power business in Salt Lake from the Utah Light and Traction Company the Utah Power and Light Company has created the Salt Lake division, which comprises Salt Lake and its environs served by the company. Mr. Green's position as division manager places him in charge of this company's business in Salt Lake and vicinity. Mr. Green came from Everett, Wash., where he has had charge of gas and electric properties. He formerly held similar positions in San Diego and Monroe, Cal., and Marshfield and Albany, Ore.

MR. CHARLES W. YERGER has recently been placed in charge of the Cincinnati office of The Cutler-Hammer Manufacturing Company, of Milwaukee, Wis. This office has been in charge of Mr. Horace L. Dawson, who has now become district sales manager at Chicago. Mr. Yerger entered the employ of The Cutler-Ham-

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Mar. 22	Mar. 15
American Tel. & Tel. (New York)	120⅜	120
Commonwealth Edison (Chicago)	137	137¼
Edison Electric Illuminating (Boston)	239	242
Electric Storage Battery common (Philadelphia)	48¾	48¾
Electric Storage Battery preferred (Philadelphia)	48¾	48¾
General Electric (New York)	139½	139½
Kings County Electric (New York)	119	119
Massachusetts Electric common (Boston)	7	7¼
Massachusetts Electric preferred (Boston)	46	47
National Carbon common (Chicago)	133	133
National Carbon preferred (Chicago)	119½	119½
New England Telephone (Boston)		132
Philadelphia Electric (Philadelphia)	24	24
Postal Telegraph and Cables common (New York)	74	72¾
Postal Telegraph and Cables preferred (New York)	65½	65
Western Union (New York)	64½	64
Westinghouse common (New York)	68¾	68½
Westinghouse preferred (New York)	117	116

mer Manufacturing Company in 1908 after graduation from the electrical engineering course at Ohio State University. Following the usual shop and test-room apprenticeship courses he spent four years in the engineering department at the Milwaukee works. When the H. B. Squires Company, of San Francisco, Pacific Cost agent for the Cutler-Hammer company, established a Los Angeles office in January, 1914, Mr. Yerger was sent there to take charge of the work.

MR. HORACE L. DAWSON formerly of the Chicago and Cincinnati offices of The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has been appointed district sales manager for the Chicago territory. Mr. Dawson began work with The Cutler-Hammer Manufacturing Company in 1907. After completing the apprentice shop course he spent two years in the engineering department of the company and then joined the sales-engineering force of the Chicago office. When the Cincinnati office in the Fourth National Bank Building was established in 1913, Mr. Dawson was put in charge and in the course of one year's time succeeded in increasing the volume of business from that territory materially, making it necessary to move to larger quarters in the Gwynne Building. Mr. Dawson is a graduate of Cornell University, class of 1907. His experience in motor control work in the engineering department combined with his wide knowledge of the practical controller requirements in all classes of industries makes him well fitted to assume the greater duties of the Chicago office territory.

OBITUARY.

MR. FREDERICK W. TAYLOR, noted engineer and inventor, died at Philadelphia on March 21 after a brief illness. Mr. Taylor is known as the originator of business efficiency and scientific management and is the inventor of many improvements in the art of cutting metals.

MR. NATHANIEL L. BRADLEY, president of the Bradley & Hubbard Company, manufacturers of gas and electric fixtures, Meriden, Conn., died at his home in that city March 15 at the advanced age of 84 years. Apoplexy was the cause of death. Mr. Bradley had been active in many civic and business organizations of Meriden and had given liberally in aid of public institutions. The widow and one son survive him.

DATES AHEAD.

Mississippi Electric Association. Annual meeting, Hattiesburg, Miss., April 12-14. Secretary, H. F. Wheeler, Hattiesburg, Miss.

Georgia Electrical Contractors' Association. Annual meeting, Atlanta, Ga., April 15. Secretary, T. H. McKinney, Atlanta, Ga.

American Institute of Electrical Engineers. Industrial Power meeting, Pittsburgh, Pa., April 15-16. Secretary, F. L. Hutchinson, 33 West Thirty-ninth Street, New York, N. Y.

Iowa Section, National Electric Light Association. Annual convention, Keokuk, Iowa, April 20-22. Secretary, W. H. Thompson, Jr., Des Moines, Iowa.

American Electrochemical Society. Annual meeting, Hotel Chalfonte, Atlantic City, N. J., April 22-24. Secretary, J. W. Richards, South Bethlehem, Pa.

Arkansas Association of Public Utility Operators. Annual meeting, Little Rock, May 11-13. Secretary, W. J. Tharp, Little Rock.

Gas, Electric and Street Railway Association of Oklahoma. Fourth annual convention, Oklahoma City, May 12-14. Secretary, H. V. Bozell, Norman, Okla.

Southwestern Electrical and Gas Association. Eleventh Annual convention, Galveston, Tex., May 19-22. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Tex.

National Electric Light Association. Annual convention, San Francisco, Cal., June 7-11. Secretary, T. C. Martin, 29 West Thirty-ninth Street, New York, N. Y.

With the Electrical Manufacturers

American Manufacturers' Agency, Incorporated, Chicago, Ill., William H. McKinlock, president, has taken the agency for the Union Electric Company's well known line of sockets, switches, attachment plugs, etc.

The Northern Chemical Engineering Laboratories, Madison, Wis., announces the adoption of a shorter name. By a change in its articles of incorporation the firm will hereafter be known as the **C. F. Burgess Laboratories.** This new name implies no change in ownership or management; Prof. C. F. Burgess remains as president. The Laboratories' activities are along the lines of chemical engineering, electrochemistry, metallurgy, research and industrial development.

Wagner Electric Manufacturing Company, St. Louis, Mo., has issued bulletin No. 106 on single-phase motors. The characteristics of these Wagner machines are carefully set forth and the advantages of using single-phase motors on central-station lines are pointed out. The bulletin has a number of illustrations of different types of these motors and of machines driven thereby.

Betts & Betts Corporation, 256 West Fifty-fifth Street, New York City, has associated with its organization Harry A. Yerkes, inventor of the famous Yerkes chimes and bells. Yerkes sound effects are noted for their charm and have been installed in many popular places, such as the New York Hippodrome, Luna Park (Coney Island), West Baden Springs Hotel, the yacht *Emeline,* etc. These chimes can be played from a regular keyboard, and the bells themselves installed in different parts of a theater, for example, with most wonderful effect. The Betts & Betts Corporation is now in position to produce these chimes of any size and effect desired, and has already contracted to install a set in another one of New York's famous restaurants.

Cooper Hewitt Electric Company, Hoboken, N. J., has begun the publication of a house-organ to be known as "The Output." The first number, which appeared on March 17, contains several interesting short articles, notably the following: "Illumination and Industrial Safety," by George Gilmour; "Lighting of the Craneways at the Ford Motor Company," by Fred Allison; "Increasing Production," by A. S. Hubbard; "Portrait Lighting with Cooper Hewitt Lamps," by M. B. Buckman, Jr. Many notes of interest to the makers, sellers and users of Cooper Hewitt lamps also appear.

The Habirshaw Wire Company, Metropolitan Tower, New York, N. Y., has placed on the market the Habirshaw splicing compound. This is made up in one-half-pound rolls, three-quarter inch and one-half inch wide. James B. Olson, secretary of the company, who was in Chicago last week attending the Electrical Supply Jobbers' convention, states that this splicing compound will be made along the same lines as the high-quality cables for which this company is famous. The compound will not be made to compete as a price proposition, as only the highest grade material will enter into its composition. Samples will be sent to users of this material upon request, and arrangements are now being made to have it carried in stock by the leading electrical supply jobbers throughout the country.

The Usona Manufacturing Company, Incorporated, recently incorporated in the states of New York and Ohio, has opened eastern offices at 1 Hudson Street, New York City, and western offices at 309 South St. Clair Street, Toledo, O. The company manufactures and markets a very extensive line of high-grade flashlights in various cases, battery lanterns, batteries and miniature lamps under the name of Kwik-Lite products. The company announces that it has secured exclusive rights to the well known Beers electric lantern, which will be added to the Kwik-Lite line. George G. Beers is in charge of the New York office, and Frank Stout, formerly with the Bryant Electric Company, is sales manager. The company has ready for distribution an attractive 31-page catalog of its Kwik-Lite products, in which some 40 types of flashlights, lanterns, dry cells, and accessories are illustrated, these and many more being listed and described. This extensive line is indicative of the long experience of this organization, which, although bearing

a new name, has been manufacturing miniature lighting products since the inception of the flashlight.

Sprague Electric Works of General Electric Company, New York, N. Y., has issued catalog No. B-3330 dealing with Sprague electric fans. The large assortment of direct-current and alternating-current fans it described and illustrated. Data on these various types are included. A leaflet form of this catalog containing condensed information on these fans has also been issued. A new edition of bulletin No. 438 on Greenfieldduct has also been issued by the Sprague Electric Works. This describes the manufacture of this type of conduit and points out its advantages. As showing the reliability of this type of duct, it is mentioned that it is extensively used on the Panama Canal, in many packing houses and in round houses of several railroads where it is subjected to severe conditions of moisture and corrosive fumes.

Aladdin Lamp Corporation, 111 Broadway, New York City, manufacturer and distributer of the Vanitie portable electric lamp, has appointed G. P. Callary as general sales manager for northern Pennsylvania, with headquarters at Scranton. Mr. Callary has been employed by the company for the past three months as field manager; during that time he appointed a number of district managers in Pennsylvania, Ohio and Michigan. L. W. Phelps, general sales manager in western Pennsylvania for the Aladdin Lamp Corporation, has turned over this sales agency to Charles C. Whithaus, 242 Oliver Building, Pittsburgh. Mr. Phelps goes to Chicago to organize a general sales agency there, and will handle all of northern Illinois. D. C. Eby has been appointed general sales manager in southern Pennsylvania and will make his headquarters at Lancaster. The Southern Electric Company, San Diego, Cal., is exhibiting the Vanitie portable lamp at the San Diego Exposition.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has received the following among recent orders: United Electric Light & Power Company, New York City, one 1,000-kilovolt-ampere, two-phase, 62.5-cycle, 2,100-volt synchronous condenser, with 27.5-kilowatt, direct-connected exciter and compound wound motor, 250 volts; three 2,000-kilovolt-ampere, air-blast, structural-steel type, single-phase, 13,200 to 3,100-volt transformers; three 500-kilovolt-ampere transformers of similar type but for 13,200 to 1,550 volts; eleven 85-kilovolt-ampere, full automatic, single-phase, 60-cycle, 2,100-volt induction regulators; one 20-panel switchboard and switching equipment. Shore Line Electric Company, electrical equipment for 10 double-truck cars comprising Westinghouse No. 632-B ventilated motors and type HL control. Ogden, Logan & Idaho Railway Company, a 50-ton Baldwin-Westinghouse electric freight locomotive equipped with Westinghouse field-control No. 562-A-5 motors and type HLF control, arranged for full speed operation on 750 or 1,500 volts. The Charleston & Interurban Traction Company, Westinghouse No. 306 motors and K-36-J control for six new passenger cars.

Record of Electrical Patents.

Issued by the United States Patent Office, March 16, 1915.

1,131,651. Thermostat. G. C. Andrews, Minneapolis, Minn. Includes vibratory contact-maker.

1,131,652. Lamp. W. F. Anklam, assignor to C. M. Hall Lamp Co., Detroit, Mich. Automobile headlight with one lamp in focus and auxiliary lamp at the side.

1,131,657. Post-Card-Printing Machine. H. Blair, San Francisco, Cal., assignor of one-half to W. R. Grogan. Includes electric lamp for lighting the box and automatic circuit-closer for the lamp.

1,131,668. Attachment for Speed-Recorders. C. A. Bowden and J. F. Gordon, Garrett, Ind. Includes contact-maker for electric alarm circuit.

1,131,673. Signaling System for Train-Dispatching. G. Brown, assignor to Western Electric Co. Telephone signal controlled over telegraph line.

1,131,678. Motor Vehicle. A. Coleman, Carmen, Okla. Gas-electric type with special chassis construction.

1,131,683. Automatic Fuel-Control System for Boilers. J. A. Doble, Waltham, Mass. Includes electric igniter and thermostatically controlled motor-driven fuel-mixture feed.

1,131,717. Combined Electric Railway and Signal System. P. W. Leffler; A. A. Leffler, administratrix of said P. W. Leffler, deceased, assignor to Leffler Electric System, Chicago, Ill. Block signaling system with supply from constant-current dynamo.

1,131,723. Lock Attachment for Sockets. R. V. Miller and J. A. Molin, Yonkers, N. Y. Includes curved ear projecting into socket, pawl lock, a spring pressing it into locking position and a key for moving it out of locking position.

1,131,724. Electric Lamp Socket. C. B. Mills, Baltimore, Md., assignor of one-fourth to A. J. Carr. Has headed pins designed to penetrate the cable.

1,131,733. Thermostat. H. T. Raymond, assignor to G. C. Andrews, Minneapolis, Minn. Special means for adjusting the contacts.

1,131,734. Line Switch. J. N. Reynolds, assignor to Western Electric Co. Automatic telephone switch.

1,131,770. Signal System. G. Brown, assignor to Brown Automatic Indicator Co., Port Huron, Mich. Electrically controlled fluid-operated signal-order-sending system and reversing gear.

1,131,797. Headlight. H. O. Sebring, Sebring, O. Has a central lamp and two side lamps, each separately controlled.

1,131,811. Selector for Machine-Switching Telephone Systems. F. Aldendorff, assignor to Western Electric Co. Trunk-hunting selector switch.

1,131,813. Electric Annunciator or Code-Signaling Device. N. L. Anthony, Cranston, R. I. Has rows of fixed contacts arranged in code order and a movable contact member.

1,131,814. Organ Stop-Action. J. T. Austin, assignor to Austin Organ Co., Hartford, Conn. Electric control.

1,131,824. Alarm Device for Motor Vehicles. F. E. Cline and W. L. Baskerville, San Diego, Cal. Alarm rings when magneto switch is closed.

1,131,831. Trolley Base. C. E. Gierding, assignor to Ohio Brass Co., Mansfield, O. Rotary turret with locking device.

1,131,832. Apparatus for Operating Bulkhead Doors. H. M. Gleason, Philadelphia, Pa. Can be operated by motor that is remote-controlled.

1,131,833. Stop-Motion for Looms. T. Goodwin and G. Cheetham, assignors to J. K. Lanning, Boston, Mass. Includes electric release.

1,131,855. Indicating Device for Annunciators and the Like. M. Nordoff, assignor to Elevator Supply & Repair Co., Chicago, Ill. Target is cam-oscillated by axial movement of core between two solenoids.

1,131,859. Electrolytic Apparatus. C. A. Parks, Chicago, Ill. Electrode consists of several parallel conducting plates and baffle plates.

1,131,870. Polyphase X-Ray System. H. C. Snook, Philadelphia, Pa. Includes phase-rectifying device driven in synchronism and supplying direct current to tube.

1,131,896. Alternating-Current Rectifier. E. C. Ballman, assignor to Wagner Electric Mfg. Co., St. Louis, Mo. Vibrating rectifier with spring vibrating at slightly below synchronism.

1,131,910. Vacuum Discharge-Tube for Lighting Purposes. G. Claude, Paris, France. Neon tube with means for absorbing by diffusion any impurities contained in the neon.

1,131,911. Call-Distributing Telephone System. H. P. Clausen, assignor to Western Electric Co. Automatic switch extends the calling line to an idle operator.

1,131,912. Telephone System. H. P. Clausen, assignor to Western Electric Co. Relates to controlling relays for distributing switches.

1,131,914. Electrical Installation for Lighting, Heating and Ventilating Railway-Carriages and Similar Purposes. A. H. Darker, England, assignor to J. Stone & Co., Ltd., Deptford, England. Reversible axle-driven dynamo with automatic switchgear.

1,131,917. Autographic Register. W. Deming, Salem, O. Projecting lamp throws on screen the matter being written.

1,131,919 and 1,131,920. Alternating-Current Rectifier. E. Fässler, assignor to Wagner Electric Mfg. Co., St. Louis, Mo. Two forms of vibrating rectifier.

1,131,921. Magneto Apparatus. R. Fischer, assignor to Mafam Motor-Apparate G. M. B. H., Frankfort-on-the-Main, Germany. Has two armatures operating together at same speed but in opposite directions.

1,131,936. Hydrocarbon Motor. A. H. Knight, assignor to Packard Motor Car Co., Detroit, Mich. Opening of ignition-circuit switch causes spark plugs to be short-circuited.

1,131,968. Electropneumatic Brake Device. W. V. Turner, assignor to Westinghouse Air Brake Co., Pittsburgh, Pa. Electric circuits for controlling the brakes and for venting air from the train pipe.

1,131,971. Electropneumatic Brake Mechanism. W. V. Turner, assignor to Westinghouse Air Brake Co. Electrically controlled means for venting air.

1,131,979 to 1,131,981. Railway-Traffic-Controlling Apparatus. F. J. Ackerman, assignor to Union Switch & Signal Co., Swissvale, Pa. Operated by reversible motor with varied control circuits.

1,131,982. Circuit-Controlling Device. F. J. Ackerman, assignor to Union Switch & Signal Co. Polarized relay.

1,132,012. Electric Pendulum Clock. A. Jabs, Zurich, Switzerland. Has two electromagnets in axial alinement.

1,132,016. Means for Forming Zones of Varying and Variable Strengths in Magnetic Fields. A. F. Jobke, Wilkinsburg, Pa., assignor of one-half to J. G. Burns, D. Bingham, K. Crumay, T. Higgins and H. P. Gazzam. The core edge is arranged in tangential zones by means of laminae of adjustable reluctance.

1,132,058. Apparatus for Bleaching and Aging Cereals. J. M. Williams, Guthrie, Okla. An electrolytically produced bleaching agent is conducted to the treating chamber.

1,132,060. Spark Plug. D. H. Yost, York, Pa. Has elongated oscillatory electrode.

1,132,087. Outlet Box. W. A. Hall, assignor to Thomas & Betts Co., New York, N. Y. Outlets have ledge seating compressible gasket upon which knockout is forced to make watertight joints.

1,132,091. Lantern. G. W. Hellstrand and E. A. Hellstrand, Chicago, Ill. Combination electric and oil lantern.

1,132,094. Contact Member. W. F. Hosford, assignor to Western Electric Co. Projecting contact disk of platinum is electrically welded at the center to strip of spring metal.

1,132,103. Fire Alarm. D. McClanahan, Stacy, Va. Self-contained battery, thermostatic circuit-closer and alarm.

1,132,106. Signaling System. H. B. Mead and H. F. Guentzler, assignors to C. F. Mead, Cleveland, O. Electric commutator calling apparatus for shops and the like.

1,132,107. Automatic Telephone System. F. Merk, assignor to Siemens & Halske A. G., Berlin, Germany. A repeater is located between the preselector and the first selector.

1,132,113. Boring and Drilling Machine. C. J. Olson, Muskegon, Mich. Driving motor and gearing are in self-contained casing.

1,132,116. Cutout Box. A. L. Pierce, Wallingford, Conn. Has sliding drop door for the open front and special supporting ribs in back.

1,132,124. Apparatus for Separating Suspended Particles from Gases. W. A. Schmidt and G. C. Roberts, assignors to International Precipitation Co., Los Angeles, Cal. Gas duct has near its end a high-tension axial electrode and a cylindrical screen electrode with internal baffle

rings surrounded externally by a dust-connecting jacket. (See cut.)

1,132,128. Apparatus for Safeguarding Automobiles from Theft. O. A. Smith, Springfield, Mass., assignor of one-half to G. A. Russell. Alarm associated with ignition circuit.

1,132,134. Step-Operating Means Controlling Starting of Electric Cars. J. A. Van Groos and O. G. Gilstrap, Portland, Oreg. Car cannot be started while passengers are still using steps.

1,132,144 and 1,132,145. Dynamo-Electric Machine. C. E. F. Ahlm, assignor to M. S. Towson, Cleveland, O. Has commutating poles between the pairs of main field poles.

1,132,154. Electric Pull-Switch. C. A. Bliley, Cripple Creek, Colo., assignor of one-half to E. A. Colburn, Jr. Pulling of central rod against force of spring closes contacts.

1,132,168. Trolley Wheel. H. R. Davidson, Lackawanna, N. Y. Special lubrication.

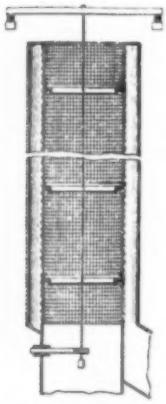
1,132,173. Flash Light. A. J. Dupont, Adams, Mass. Can be attached to the back of the hand and includes lamp, switch and a parallel-sided battery in a case.

1,132,183. Battery Separator. C. P. Hidden, New York, N. Y. Has several porous walls separated by buttons.

1,132,186. Traffic-Signaling System. E. W. Kelley, Rochester, N. Y. A system of electric audible signals distributed in the streets and controlled from a central point to clear a path for fire apparatus or the like.

1,132,187. Ventilating Fan. S. M. Keyte, Oakland, Cal. Has triangularly housed display blades with electric lamps to illuminate the housings.

1,132,205. Speed-Control Device. W. S. Menden, Brooklyn, N. Y., assignor to Megosin Co. Circuit-breaker in motor circuit opens when predetermined maximum speed is exceeded.



No. 1,132,124.—Electrostatic Dust Precipitation.

1,132,245. Fire-Alarm System. J. B. Ammons, Houston, Tex., assignor of one-tenth to E. Ammons and one-fifteenth to O. McGaffey. Fusible and explosive means close alarm circuit.

1,132,249. Signaling Device for Party Telephone Lines. L. Ericson, assignor to Kellogg Switchboard & Supply Co., Chicago, Ill. Telephone ringer.

1,132,259. Inclosed Arc Lamp. C. A. B. Halvorson, Jr., assignor to General Electric Co. Flame lamp with annular condensing chamber about upper part of casing.

1,132,262. Method of Treating Metal Structures to Prevent Subsequent Change in Form. J. O. Heinze, Jr., assignor to General Motors Co., Detroit, Mich. Process of equalizing internal molecular stresses by subjecting the metal to electromagnetic alternations.

1,132,265. Liquid Sterilizer. V. Henri, A. Helbronner and M. von Recklinghausen, assignors to The R. U. V. Co., Inc., New York, N. Y. While flowing in thin film the liquid is subjected to radiation from quartz-tube mercury-vapor lamp.

1,132,266. Apparatus for the Treatment of Water and Other Liquids by Ultra-Violet Rays. V. Henri, A. Helbronner and M. von Recklinghausen, assignors to The R. U. V. Co. Modification of above.

1,132,267. Electric Signaling Apparatus and Circuits. F. B. Herzog, New York, N. Y.; H. Herzog, executrix of said F. B. Herog, deceased. Includes means for setting up code signals.

1,132,277. Lamp-Making Machine. N. Marshall, assignor to General Electric Co. For forming incandescent-lamp stems.

1,132,281. Reactive Coil. W. S. Moody, assignor to General Electric Co. In shape of a double cone with bases adjoining.

1,132,294. Electric Coupling or Connector. J. Wilkie, Crosshill, Glasgow, Scotland. For connecting fixture to circuit wires.

1,132,297. Electrical Equipment for Internal-Combustion Engines. V. G. Apple, assignor to Apple Electric Co., Dayton, O. Adjustable coil-supporting terminals for the secondary can be telescoped within hub.

1,132,299. Electric Flatiron. H. P. Ball, assignor to General Electric Co. Detachable terminal plug can be oscillated on handle with snap action to act as switch.

1,132,304. Brush-Holder and Terminal for Connecting Electric Cable. R. H. Cunningham, assignor to Splitdorf Electrical Co., Newark, N. J. For use on ignition generator.

1,132,307. Arc Lamp. J. T. H. Dempster, assignor to General Electric Co. Upper electrode comprises two converging members with a bar of fusible light-giving material between them.

1,132,308. Graphic Recording Apparatus. J. T. Dempster, assignor to General Electric Co. Time-actuated recording sheet for electric meter.

1,132,313. Flame-Arc Lamp and Electrode Therefor. G. Egly, assignor to Gebruder Siemens & Co., Berlin-Lichtenberg, Germany. The negative electrode contains a slag-removing admixture in the form of borates evenly distributed throughout its mass.

1,132,322. Electrical Measuring Instrument. A. J. R. Fiego, assignor to General Electric Co. Includes circular resistance-adjusting switch.

1,132,345. Card-Testing Device. H. Hollerith, Washington D. C. Circuit of motor driving the card feed is broken when potential points between which the cards pass come in contact.

1,132,355. System of Electrical Wiring. W. J. Kistler, Coopersburg, Pa. Molding system in which each wire is surrounded by insulating tube and each pair covered by metal sheath with dividing wall between the two insulating tubes. (See cut.)

1,132,385. Spark Plug. O. Rickmeyer, Milwaukee, Wis. Cleaning device mounted on one electrode.

1,132,388. Coupling or Splice for Trolley Wires. G. W. Robinson, Baltimore, and M. E. Harding, Odenton, Md. Splicing ear with inclined wire-receiving sleeves.

1,132,394. Manufacture of Chemically Pure Soluble Silicic Acid. B. Schwerin, assignor to Elektro-Osmose A. G. (Graf Schwerin Gesellschaft), Frankfort-on-the-Main, Germany. Alkaline silicate solution is subjected to double electrolysis.

1,132,400. Apparatus for Indicating and Recording Small Differences of Fluid-Pressure and for Operating Integrating or Control Devices which Have to be Regulated by the Said Differences of Pressure. F. Simpson, Blundellsands, near Liverpool, England. Electrically controlled.

1,132,404. Electropneumatic Sound-Box. Curt Stille, Zehlendorf-West, near Berlin, Germany. Includes a sound transmitting electromagnet mounted on the diaphragm.

1,132,408. Train-Stopping Apparatus. J. H. Upton, Bryson City, N. C., assignor of one-half to J. Tabor. Electroresponsive device to cut off the power of the car.

1,132,413. Pump. F. H. Whipple, Visalia, Cal. Has common end wall between driving motor and centrifugal pump.

1,132,418. Train-Signal Apparatus. J. S. Allen, New York, N. Y. Electrically operated.

1,132,419. Automatic Fire-Alarm System. J. B. Ammons, Houston, Tex., assignor of one-tenth to E. Ammons and one-fifteenth to O. McGaffey. Modification on No. 1,132,245.

1,132,427. Electromechanical System to Avoid Railway Collisions. A. Beer, Venice, Italy; C. Beer, widow of C. D. Bonamini, heir at law of said A. Beer, deceased. Block signaling system.

1,132,442. X-Ray Tube. M. S. Clawson, Weehawken, N. J. Has anode with a button of a different metal imbedded therein and corrugated to provide maximum contacting surface.

1,132,444. Circuit-Controller. J. P. Coleman, assignor to Union Switch & Signal Co., Swissvale, Pa. The periphery of a sleeve is tapered and a contact member mounted on the sleeve has a bore tapered to match the periphery.

1,132,445. Electric Motor. J. B. Conrad, Nicolaus, Cal. Solenoid engine.

1,132,450. Automatic Train-Control System. L. R. C. Crim, Altmar, N. Y. Electric control of air-brake system.

1,132,451. Multiple-Conductor Electrical Cable. C. W. Davis, assignor to Standard Underground Cable Co., Pittsburgh, Pa. A number of insulated conductors grouped about a central body formed of wrapped paper.

1,132,452. Multiple-Conductor Cable. C. W. Davis, assignor to Standard Underground Cable Co. An incomplete integument of conducting material covering the opposing faces of each of the assembled insulated wires and extending outwardly.

1,132,454. Binding-Post. F. H. Day, Dawson, Yukon Territory, Canada. Has a number of wire-clamping members mounted upon the stem one above the other.

1,132,464. Jig. G. H. Elmore, Swarthmore, Pa. Float-controlled circuit-closer governs an electromagnetically actuated pawl.

1,132,470. Switch. D. D. Gordon, assignor to Gordon Electric & Mfg. Co., Chicago, Ill. Push-button flush wall switch.

1,132,473. Circuit-Controller. C. O. Harrington, assignor to Union Switch & Signal Co. Oscillating contact segment and brush gear.

1,132,478. System of Electrical Distribution. J. L. Johnson, assignor to Allis-Chalmers Mfg. Co., Milwaukee, Wis. Flywheel-regulated generator for balancing variable-load circuit.

1,132,485. Gas-Lamp Control and Igniter. W. F. Oeftger, Detroit, Mich. Electric igniter.

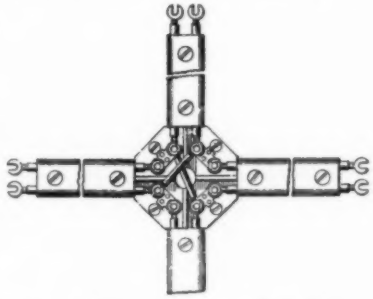
1,132,499. Fire-Alarm System. N. H. Suren, assignor to Gamewell Fire-Alarm Telegraph Co., New York, N. Y. Interconnection of central station and local alarm boxes.

1,132,500. Terminal Clip. L. A. Thomas, Evansville, Ind. Connector made of a single length of wire bent upon itself.

1,132,523. Manufacture of Incandescent Filaments of Metallic Tungsten or Molybdenum for Electric Incandescent Lamps. A. Lederer, Atzgersdorf, near Vienna, Austria-Hungary. Made from the metal in a powdered state combined with camphor as agglutinant.

1,132,532. Portable Electric-Lamp Stand. A. Bouchery, assignor to Wallace Novelty Co., New York, N. Y. The shade can be set upon lamp bulb and also clasped inverted to the base of the lamp stand for compact shipment.

Reissue, 13,891. Telephone-Exchange System. S. H. Browne, assignor to American Telephone & Telegraph Co. Original No. 1,073,589, dated Sept. 23, 1913. Automatic call-distributing system.



No. 1,132,355.—Metal Molding System.

Patents Expired.

The following United States electrical patents expired on March 22, 1915:

600,866. Electrical Alarm Gauge. J. Hackney, Norfolk, Va.

600,874. Electrical Device for Propelling Boats. L. R. Jones, Boston, Mass.

600,890. Trolley Wheel. E. R. Robinson, Chicago, Ill.

600,896. Pneumatic Controlling System for Electric Cars. S. H. Short, Cleveland, O.

600,937. Electric Contact Box. J. N. Thomas, Johnstown, Pa.

600,941. Magnetic Clutch and Power-Station System. B. J. Arnold, Chicago, Ill.

600,966. Damper Governor. C. Kummer and L. Bertrand, Easton, Pa.

600,969. Electric Circuit-Closing Device. G. Newman, El Paso, Texas.

600,981 to 600,983. Electrical Measuring Instrument. E. Weston, Newark, N. J.

600,990. Telephone. G. F. Payne, Philadelphia, Pa.

600,991. Telephone Transmitter. G. F. Payne and W. D. Gharky, Philadelphia, Pa.

601,023. Alternating-Current Motor. W. Langdon-Davies, London England.

601,042. Battery. W. Morrison, Montclair, N. J.

601,108. Cluster Fixture for Electric Incandescent Lamps. N. Weeks, New York, N. Y.

601,172. Portable Camera for Roentgen-Ray Photography. G. Seguy, Paris, France.

601,195. High-Potential Insulator. J. W. Boch, East Liverpool, O.

601,206. Brake for Electric Motor Cars. P. B. Hayes and H. M. Carbine, Chicago, Ill.